BBC wildlife

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10
DEADLY
FISH

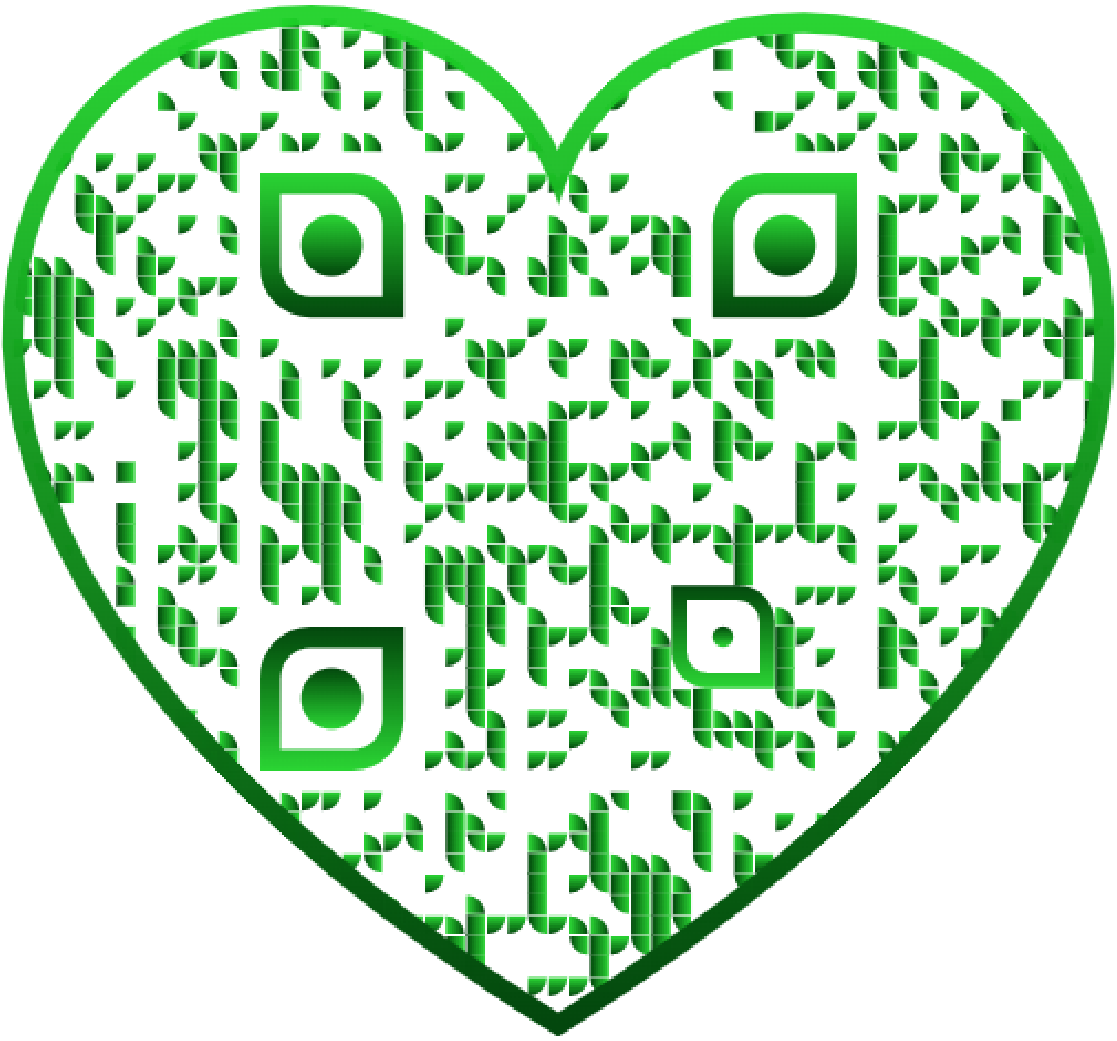
Brazil's secret crab island

On the prowl with polar bears

Big cats in Britain

REBORN IN THE USA

One woman's mission to save the bald eagle



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Fungi: The Web of Life

BBC iPLAYER Biologist and writer Merlin Sheldrake unravels the many secrets of these essential organisms that shape the weather, support life on land, are at the cutting edge of medical research, and even have the power to break down plastic waste.
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Rare Earth

BBC SOUNDS The toughest drought on record has helped spread fires in the Amazon that have been the worst in two decades. In the episode titled *Amazon Future*, the rainforest's role in the global climate is considered, as well as its future.
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Britain's red kites have come back from the brink

Keeping your eyes peeled pays off

PAUL McGUINNESS, EDITOR

Not many things interupt our games of garden cricket, but play came to a halt near the end of last summer when I spotted a red kite way off in the distance. Living in the West Country, I'd never seen one this close to home before, and, as it came closer, we were spellbound as it came low over our heads.

But it's not the most exotic animal I've heard of in these parts. A close family member came back from a trip over the moors about 30 years ago buzzing with excitement at having seen a very large black cat run in front of the car. This was the fabled Beast of Exmoor, and it was the first time I had considered that claims of black leopards roaming our countryside could hold water.

The evidence today is compelling, as we report on p60. And if you see anything unexpected, please do write in and tell us. Enjoy the issue!

Paul

COVER IMAGE: ALAN MURPHY/NATUREPL.COM; RED KITE: KIRK NORBURY/ALAMY; BELUGA WHALE: STEVEN J KAZLOWSKI/ALAMY; FUNGI: ALAMY

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BBC Wildlife No. 02 Vol. 43

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THE COVER

Our cover star this month is a bald eagle, the national animal of the USA. Photographer Andy Murphy spotted this individual perching on a spruce tree in the snow. He used a Nikon D5, Nikon 300 2/8 lens, 1/1600sec f5.6, ISO1600.

40

Breathtaking images of polar bears

POLAR BEARS: FLORIAN LEDOUX; SLOW LORIS: GARRY LOTULUNG; BEE: PHIL SAVOIE/NATUREPL.COM; TEASEL: TIM GAINEY/ALAMY

Every month, only in *BBC Wildlife*

NICK BAKER
"It did look for all the world like a monkey nut with wings, and one sprinkled with icing sugar" *P.36*

GILLIAN BURKE
"Plants are more than carbon stores – they are living, breathing, climate co-creators" *P.27*

MARK CARWARDINE
"Fox hunters argue that their barbaric bloodsport should continue because it is a British tradition" *P.30*

LUCY COOKE
"Cameras recorded a whopping 80 per cent of tinamou eggs being eaten by predators" *P.29*

MIKE DILGER
"In hunting mode, an orca often swims on its side to hide its distinctive dorsal fin from its quarry" *P.32*

08 Wild Times

Catch up with all the latest developments and discoveries making the headlines

18 Feeding birds may kill them

Birdfeeders are changing the ecological conditions for certain species and not for the better

32 Orca hunting strategies

It's sealion season on the Argentinian coast for these wolves of the sea

36 Hidden world

The tropical bug with a hulking head extension

40 On the prowl with polar bears

A remarkable photo feature following these impressive beasts across wintry wastes

52 Slow but sure

Conservation efforts are reversing the decline of the Javan slow loris

60 Big cats in Britain

The truth behind rumours that black leopards and the like are living in the UK

64 Reborn in the USA

One woman's quest to bring the bald eagle back from the brink

72 Brazil's secret crab island

Meet the charismatic crustaceans hiding away on a naval outpost

DON'T MISS...

...seven beautiful wild spectacles to enjoy this month, from frosted teasels to wild geese
Page 22

52

Saving the slow loris in Indonesia

Discover MORE

Read about queen bees on p81

80 Q&A

What is the slowest land animal and how do crocodiles mate?

86 Species guide

All you ever wanted to know about wolves

88 Photo Club

Including Snap Chat

93 Crossword

Plus Spot the Difference

94 Your Letters

Join the debate

98 10 deadly fish

The marine species it would be wise to avoid, from stonefish to electric eels

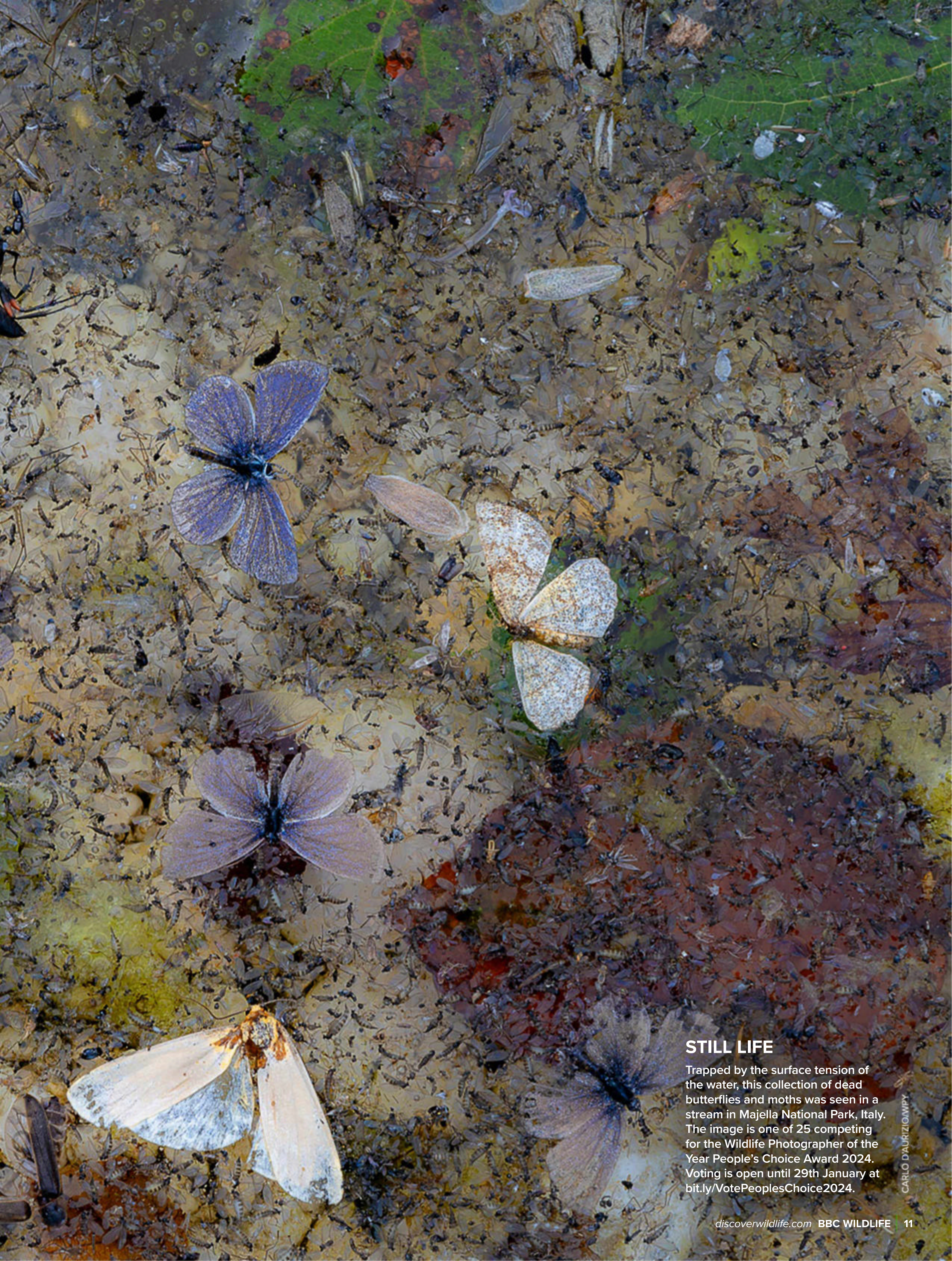
wild TIMES

The latest news, photography and seasonal wildlife highlights

ON THE INSIDE

A mesmerising ghost glass frog hides within a curled *Heliconia* leaf in Costa Rica. Glass frogs are found in Central and South American rainforests and are so-called because they have translucent bellies and chests, allowing lucky observers to see their blood pumping and food being digested.

GUY EDWARDES/NATUREPL.COM



STILL LIFE

Trapped by the surface tension of the water, this collection of dead butterflies and moths was seen in a stream in Majella National Park, Italy. The image is one of 25 competing for the Wildlife Photographer of the Year People's Choice Award 2024. Voting is open until 29th January at bit.ly/VotePeoplesChoice2024.

CARLO D'AURIZIO/WPY

Salmon to surge after largest dam removal project in history

California's Klamath River in recovery following large-scale restoration

To the Yurok tribe who inhabit northern California, the Klamath River is "the bloodline, the lifeblood of the people" because of the vast numbers of Chinook and coho salmon and steelhead trout that used to migrate upstream and into its tributaries to spawn each year.

Dam-building for hydro-electricity, which began in 1908, had a catastrophic impact on this once abundant resource, cutting off the fishes' routes to their spawning sites.

But now, after decades of negotiation involving federal and state authorities and indigenous (not just the Yurok) and environmental groups, four major dams have been removed, and the salmon and trout can travel upriver once again.

The first dam came down in the summer of 2023, with the removal of the others – the largest more than 50m in height and 225m long – beginning in early 2024 and completed towards the end of the year.

According to the Klamath River Renewal Corporation, which has overseen the project, fish now have access to more than 640km of river in the Klamath's upper basin.

The US non-profit environmental group American Rivers has welcomed the development. "The Klamath is significant not only because it is the biggest dam removal and river restoration effort in history, but because it shows that we can right historic wrongs and make big, bold dreams a reality for our rivers and communities," says California director Ann Willis.

Ongoing restoration efforts are focusing on reseeding the nearly 900ha of previously submerged land with native tree species, as well as monitoring the river for both water quality and returning fish numbers.

According to American Rivers, there are more than 500,000 dams in the USA, 85 per cent of which are more than 50 years old – the average lifespan of a dam. Dams are the leading cause of freshwater biodiversity loss, the group says, and a source of methane emissions (due to decomposing organic matter), a more potent greenhouse gas than carbon dioxide. **James Fair**

Salmon such as Chinook (*pictured*) and coho are recolonising their former breeding grounds

SALMON: PETER MATHER/MINDEN/NATUREPL.COM

Red squirrels are specialist tree-seed feeders, and have declined sharply in the UK

AI brings hope for rare reds

New tech 'Squirrel Agent' can target invasive greys at feeders

Artificial intelligence (AI) is being utilised to help save the UK's endangered red squirrels. The groundbreaking technology, known as Squirrel Agent, has been trained to spot the difference between red and grey squirrels in a bid to manage feeders meant for red squirrels and, ultimately, control populations.

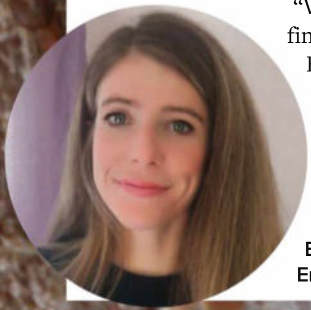
The UK's only native squirrel, reds have been under threat since the introduction of greys from North America in the late 19th century. Today, greys are thought to number some 2.7 million versus only a few hundred thousand reds. This is largely because greys are bigger, outcompeting reds for food and territory, and carry squirrelpox, a disease deadly to reds. Collectively, these pressures have pushed red squirrels to the brink of extinction.

Squirrel Agent, which claims a 97 per cent accuracy rate, recognises reds by their size, shape and weight, and features such as tails, faces and ears. Feeders are then remotely opened for reds or, for greys, kept closed, instead opening traps or encouraging them to consume contraceptives.

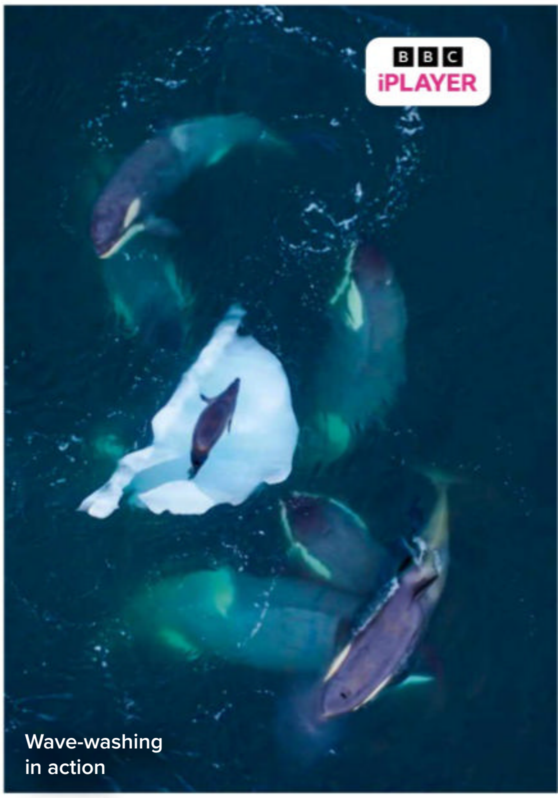
"It's a real showcase of what AI can do – it's working in real time to do a task that we don't have enough [human] volunteers for," says Emma McClenaghan, co-founder of Genysys Engine, which developed the system.

Project Red Haven, as the programme is known, is being tested by five wildlife charities, including the Scottish Wildlife Trust and Ulster Wildlife. But this is just the beginning. It's hoped that the tool's tech will evolve sufficiently to not only identify different species, but also individuals.

"Whiskers are like human fingerprints," says McClenaghan. By distinguishing squirrels through their whiskers, AI will build data over time to help conservationists track family lines. **Kirsten Henton**



Emma McClenaghan of Genysys Engine, which developed the tech



Wave-washing in action

Expedition Killer Whale

In a remote corner of Antarctica, a group of around 100 killer whales has developed an extraordinary method of hunting, known as wave-washing. Swimming together, they create powerful waves that wash their seal prey off floating ice. The behaviour was filmed for the 2011 BBC One series *Frozen Planet*, and again, this time from the air, for *Frozen Planet II*.

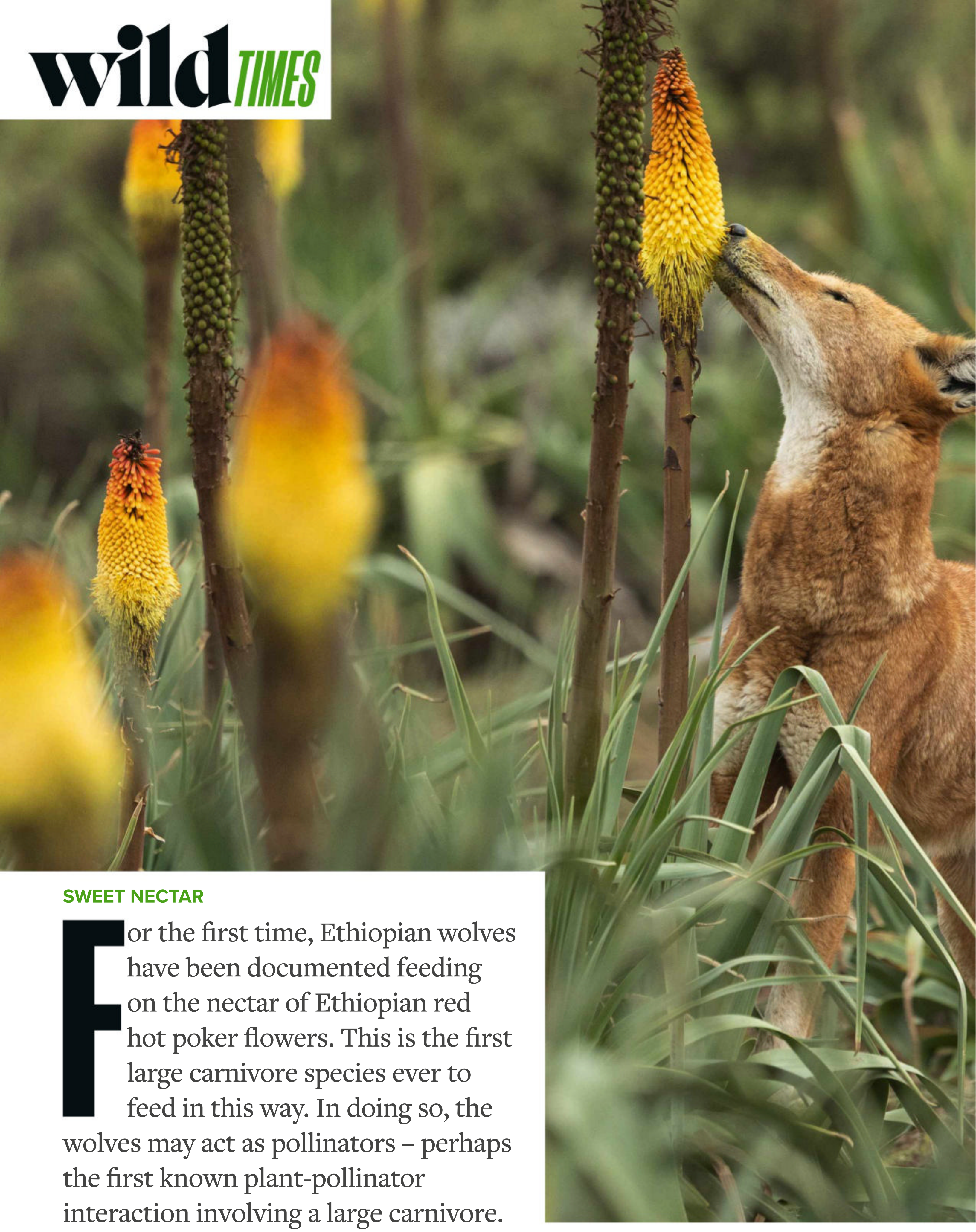
Now, these predators are back on our screens with *Expedition Killer Whale*, an hour-long film for BBC Two and iPlayer. The documentary follows a group of scientists and film-makers as they head into these icy waters to further understand the species and its highly sophisticated hunting behaviour.

"Killer whales generally incite feelings of fear – they're seen as fierce, ruthless hunters," says executive producer Orla Doherty. "But *Expedition Killer Whale* sets out to reveal an entirely different side to these creatures. We dive deep into the matriarchs, whose role is to pass on a lifetime of hunting knowledge to the generations below. Our intention is to educate a global audience on their tender, family side."

Highlights include a female leading a 'teaching session' in how to hunt crabeater seals, and the first-ever audio recordings of the sounds that killer whales make when actively seeking prey. **Sophie Ellis**

RED SQUIRREL: SCOTLAND: THE BIG PICTURE/NATUREPL.COM; KILLER WHALES: SAM STEWART/BBC STUDIOS

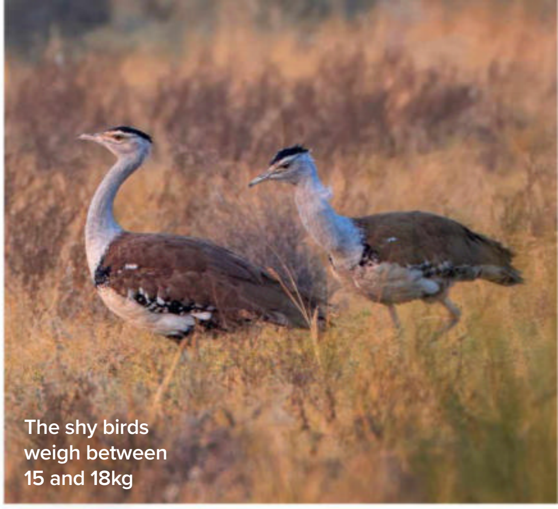
wild TIMES



SWEET NECTAR

For the first time, Ethiopian wolves have been documented feeding on the nectar of Ethiopian red hot poker flowers. This is the first large carnivore species ever to feed in this way. In doing so, the wolves may act as pollinators – perhaps the first known plant-pollinator interaction involving a large carnivore.

Ethiopian wolves pick up pollen on their snouts and may pass it to other flowers



The shy birds weigh between 15 and 18kg

Big step for great Indian bustards

Artificial insemination offers a ray of hope

The future of India's critically Endangered great Indian bustard (GIB) is looking up. The first chick conceived by artificial insemination recently hatched in a victory for the country's Bustard Recovery Program.

GIBs, some of the world's heaviest flying birds, are seriously threatened by hunting and habitat loss, with fewer than 200 in the wild. Once found across 11 states in western India, today these big birds are generally restricted to Rajasthan and Gujarat. Habitat has been lost to industrialised farms and renewable energy infrastructure, such as wind turbines, and the birds' poor eyesight can lead to collisions with powerlines, fences and cars. "The only solution to conserve the GIB is to preserve its natural habitat," says conservation ecologist Sumit Dookia.

In the meantime, researchers are trying to keep numbers up at two conservation breeding centres in Jaisalmer, Rajasthan. Initially, they collected wild eggs and hatched them in incubators, before moving on to artificial insemination. Currently, there are 45 birds across both centres, 14 of which are captive-bred chicks, including the one born through artificial insemination. It's hoped this recent breakthrough will lead to the creation of a sperm bank.

While the overall aim is to release these captive birds, there is caution. As well as human handling for breeding and feeding, which reduces their ability to survive in the wild to around 30 per cent, the underlying issue of habitat loss remains. As Dookia states, "It will be extremely challenging to rewild them, especially if there's no habitat left for the birds to be released into."

Kirsten Henton

ETHIOPIAN WOLF: ADRIEN LESAFFRE; GREAT INDIAN BUSTARD: MIHIR JOSH/ALAMY

Feeding birds may kill them

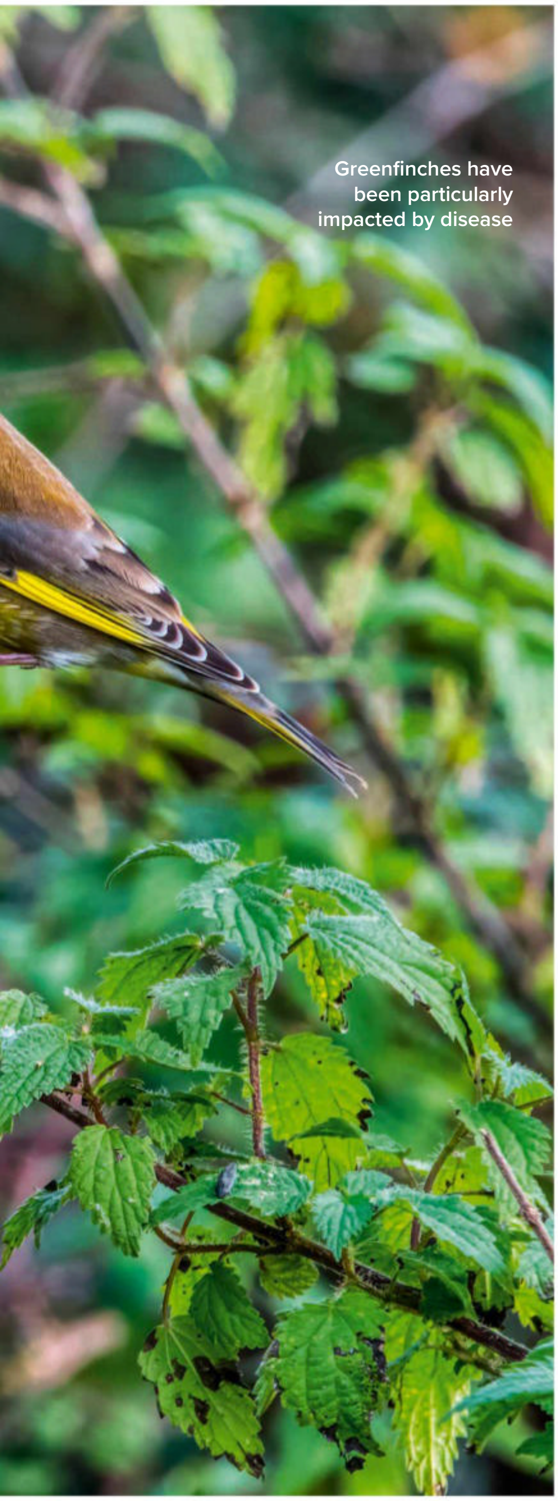
We love to attract birds to our gardens, but feeders can pose a deadly risk

Eight or so years ago, Dick Woods was attracting an estimated 50 greenfinches to the birdfeeders outside his converted barn near Canterbury, Kent. They vastly outnumbered the other species, and then – over a just a couple of weeks – they completely disappeared.

Woods's visitors had succumbed to a deadly disease that has killed around 70 per cent of British greenfinches: trichomonosis, a parasite that first jumped to songbirds from pigeons around 2005. It's thought to be spread mainly on and around birdfeeders, and this got Woods, who is a design engineer by trade, thinking.

The result was Finches' Friend, a redesigned birdfeeder that Woods manufactures at home and says reduces disease transmission. Trichomonosis is spread in saliva, and infected birds regurgitate their food. "You don't want birds walking, vomiting and defecating in the food provided, so the first thing to do is stop that," he says. That means the feeder can't be open for birds to walk in, as in some models.

You also don't want one bird to drop food from one feeding position onto another below, or the feeder to have open ports into which rain can pour, as the parasite survives better in wet food. Smaller feeders are better, too, because food isn't sitting around in them for long periods. Woods has also introduced nifty features that make his



Greenfinches have been particularly impacted by disease

A great tit makes the most of a fatball

“If you change the ecological conditions for one species in a landscape, that’s going to have knock-on impacts”

design easier to clean (in my experience, this is objectively true).

But he can’t say for sure that his products are effective. He’s tried to persuade conservation groups such as the RSPB to carry out studies to see if they can protect finches (the group most prone to trichomonosis), but has so far been met with a metaphorical shrug of the shoulders.

As well as greenfinches, chaffinches have been hit, declining by nearly 40 per cent in the past decade, while goldfinches, in contrast, have largely gone the other way, benefitting from supplementary food – for reasons that are still not fully understood.

But finches are arguably just the most high-profile victims of our desire to feed the songbirds in our gardens. An estimated 64 per cent of British households do it, spending a staggering £250 million on 150,000 tonnes of sunflower and nyjer seeds, peanuts and assorted fatballs. It’s enough to feed the entire UK populations of the 10 commonest garden birds three times over.

Globally, the birdfood market is valued at $5-6 billion (£4-4.75 billion) and it’s growing at four per cent a year. The broader negative impact this is having is slowly becoming clearer. In a way, points out Alex Lees, a reader in conservation ecology at Manchester Metropolitan University, we shouldn’t be surprised that there is one. “We’ve been feeding birds for a very long time and slowly ramped up the quantities, but we have never properly interrogated the consequences of what we’re doing,” he says. “If you change the ecological conditions for one species in a landscape, then that’s going to have knock-on impacts for others.”

The best example in the UK is how birdfeeding is favouring great tits and blue tits over marsh tits and willow tits. Numbers of great tits, for example, have nearly doubled since the 1960s. The latter have

TIPS TO KEEP BIRDS HEALTHY

- Clean feeders at least once a week with warm, soapy water and ideally a disinfectant (soaking in a bleach solution is recommended).
- Clear away spilled food below feeders so you’re not attracting rats and other rodents.
- Be vigilant for signs of disease – birds with trichomonosis will have difficulty swallowing, drool saliva, regurgitate food, show laboured breathing, have a swollen neck or throat and look lethargic and thin.
- Symptoms for other possible diseases (such as salmonellosis) are similar. If you suspect an outbreak, stop feeding your birds for at least two weeks.
- Consider feeding birds less and, if you have a garden, instead plant trees and shrubs that will attract and nourish visiting birds.

GREAT TIT: ALAMY; CLEANING: GILLIAN PULLINGER/ALAMY; GREENFINCHES: ALAMY

Goldfinches flock to teasel in autumn

GOLDFINCHES:ALAMY

“There is ample evidence that feeding birds helps to sustain populations and improves breeding success”

more specialist niches, with willow tits, for example, better than the others at exploiting newer (early successional) woodlands because they are the only one of the four species that creates its own nest-holes, rather than using naturally occurring ones.

But birdfeeding has allowed blue and great tits to flourish in numbers far exceeding their normal abundance. They then move into these niche habitats and displace willow tits from the very nest-holes they have spent vital energy digging out.

Where conservation groups put up nestboxes in these woodlands, this is further helping the generalist blue and great tits. Warmer winters – a phenomenon linked to humans, though not birdfeeding in particular – are further increasing their survival rates. And increasing numbers of great spotted woodpeckers – another beneficiary of birdfeeding – is another factor in the willow tits’ demise, because they raid their nests.

Does that mean we should all stop feeding birds? Are we actually doing more harm than good, even if we are meticulous about cleaning our feeders to stop disease spreading? Well, no, not quite – or not yet. The RSPB says it is conducting “a comprehensive scientific review, which includes looking at the advice we give and the products we sell in the light of all the latest science,” and it expects to report back in the early spring.

KATE PLUMMER, A SENIOR RESEARCH ecologist at the British Trust for Ornithology (BTO), points out there is ample evidence that feeding birds, especially in the winter and early spring, helps to sustain populations and improves breeding success. “We are still in the camp that positives outweigh the negatives, but that could change,” she says.

Plummer also makes the point that birdfeeding has other benefits, such as engaging people with nature. “And there’s evidence this encourages pro-conservation behaviour and awareness, so feeding birds is not just beneficial in the garden,” she says.

But doubts persist. Seeds that drops from feeders onto the ground can encourage rats, which may result in greater and sometimes irresponsible use of poisons. “We know that second-generation anti-coagulant rodenticides are ubiquitous in raptors,” says Lees. “They’re in 80 per cent of sparrowhawks, 60 per cent of kestrels and a study due soon has evidence that they’re in 100 per cent of buzzards and kites.”

These birds of prey are ingesting these poisons from prey or carrion, some of which will have come from homeowners dealing with an outbreak of rats. “You buy the bird food, and next to that in the store is the stuff for killing rats and mice,” Lees points out.

Feeding birds is undoubtedly fun. Lees himself has been a regular feeder in the past, including in the Amazon, where he put out sugar solution to attract hummingbirds. Many lodges across Central and South America do the same. Provisioning of meat for vultures is another growing tourist activity, and in the USA, this has been vital for the survival of the California condor.

But here in the UK, has it become too commercial, with even conservation groups using it as a way to fill their coffers without considering the ramifications? Are we seeking an instant fix, rather than waiting for goldfinches to search for scattered teasel seeds in autumn or great tits to glean caterpillars from fruit trees in spring? Perhaps we should try relearning the value of patience rather than wallowing in the hedonistic rush of a feeder full of finches.

ABOUT THE AUTHOR

James Fair is a wildlife journalist with a specialism in conservation and controversial issues. Read more at jamesfairwildlife.co.uk.

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wild FEBRUARY

7 nature encounters for the month ahead

WITH NATURALIST AND AUTHOR BEN HOARE

Barnacle geese are grazers, picking at leaves, stems, roots and seeds

1

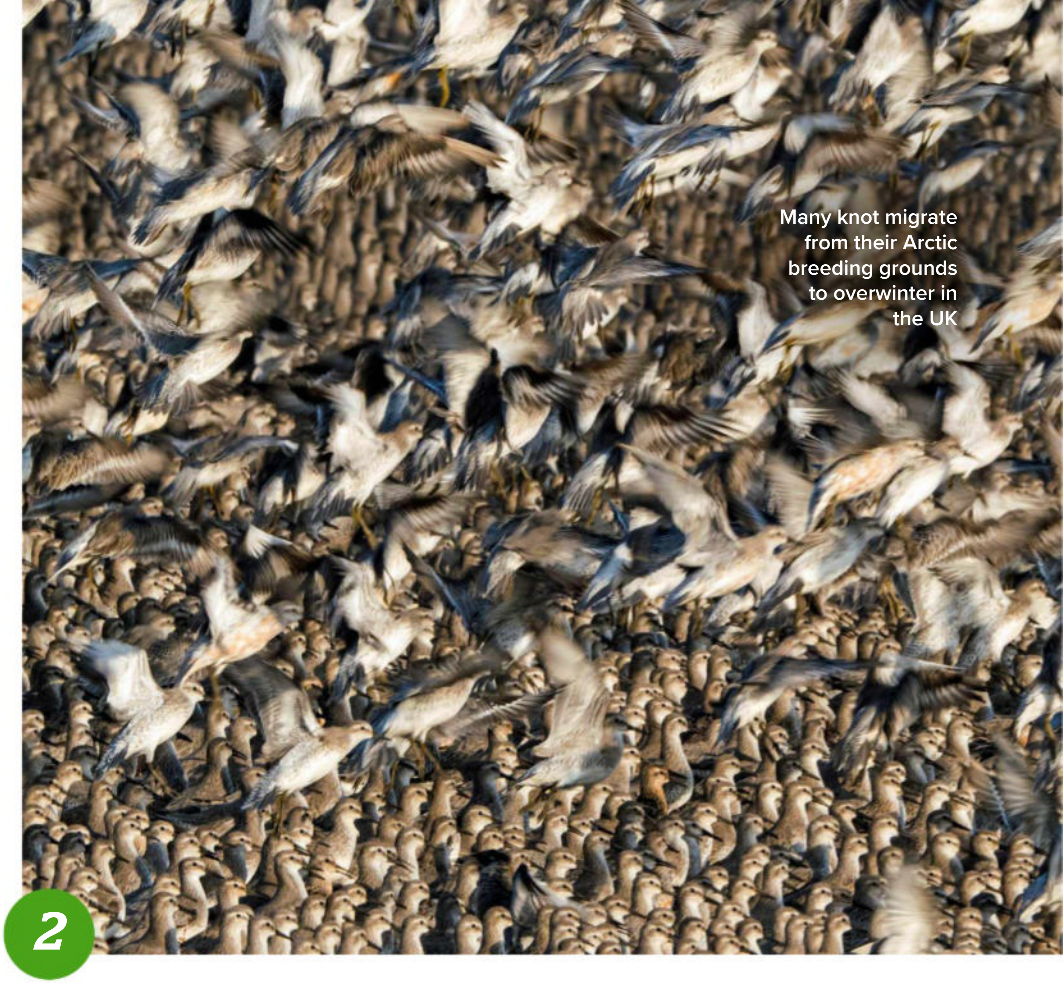
Welcome sound

TIME FOR A MUCH-NEEDED GOOD news story. The barnacle geese that spend winter in south-west Scotland appear to have recovered after a third of this population died of bird flu in 2020-21. Spectacular, yapping flocks of these lovely geese, which breed on Svalbard, a remote Arctic archipelago, commute daily between feeding areas along the Dumfries and Cumbrian coast and roost sites in the muddy Solway Firth.

All together

BRITAIN'S WINTER FLOCKS OF WADING birds are among the country's greatest natural spectacles. Knot form the largest of these gatherings. They are thick-set sandpipers, closely related to dunlin, which spend the winter almost exclusively on muddy estuaries, seldom venturing inland. Their biggest flocks peak at more than 100,000 individuals – a thrilling sight.

The mighty flocks assemble during the incoming tide, as rising sea water pushes the feeding knot closer together. Eventually, the huge mass of birds is forced to seek refuge on the shore or on mudbanks left uncovered by the water. Settled at last, the birds congregate in a dense scrum to sit out the high tide, after which they can begin feeding again. But the roosting knot stay edgy. They're easily spooked – perhaps by a dog running off the lead, or by a raptor such as a peregrine. Erupting into the air, the flocks of knot move as one, twisting and turning over the mudflats in a silvery version of a starling murmuration, before settling once more.



Many knot migrate from their Arctic breeding grounds to overwinter in the UK

2

3

Frosted teasel seedheads are a beautiful sight

Wild side

FAR TOO OFTEN, WE'RE UNABLE TO resist the urge to tidy our gardens and other outside spaces. We sweep and rake, deadhead and strim, but while all this effort gives the appearance of order, it is hardly ideal for wildlife. For example, if left on plants, dry seedheads can provide overwintering sites for lacewings, ladybirds and a host of other invertebrates, while the seeds themselves are food for birds and mice. The seedheads are attractive in their own right, too. In her guided nature journal *Homecoming*, Melissa Harrison describes her ritual of bringing a few seedheads of honesty, teasel and quaking grass indoors to enjoy through the winter, "souvenirs of the season past".

Spiky teasel seedheads look particularly impressive in wintry gardens, and their oily little seeds are much loved by goldfinches. Francis Darwin, third son of Charles Darwin, wondered if teasel might actually be a meat-eating plant in summer on account of how many tiny flies get caught and die among its tightly packed prickles. Later studies have both supported and questioned this intriguing idea – the jury is still out!

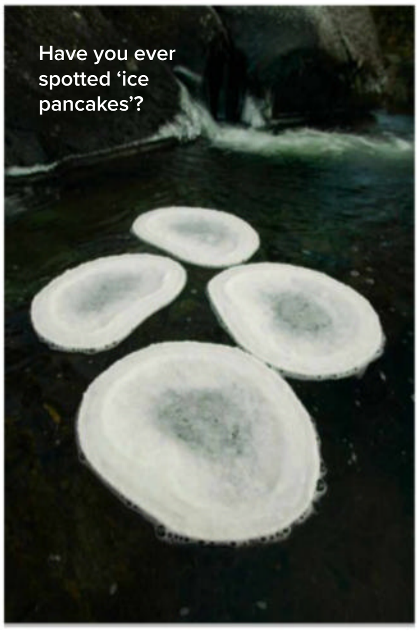
BARNACLE GEESE: DAVID TIPLING/2020VISION/NPL.COM; KNOT: SIMON STIRRUP/ALAMY; TEASEL: TIM GAINEY/ALAMY

Take time to notice feathery hoar frost this winter

Bleak beauty

IT IS A STRANGE THING THAT WHEN THE cold is most vicious the sun is already well on its way back," says Charles Foster in his beautiful book *Cry of the Wild*. And it's true. February, which arrives a full six weeks after the winter solstice, when the days are lengthening noticeably, is often the coldest month of the year in Britain.

Plunging February temperatures bring their own rewards, though. The ice crystals of hoar frost can be seen coating bare twigs and branches first thing in the morning and pendulous icicles hang from the roofs of sheds and houses, while spectacular 'ice pancakes' form when the foam on swirling rivers freezes into discs.



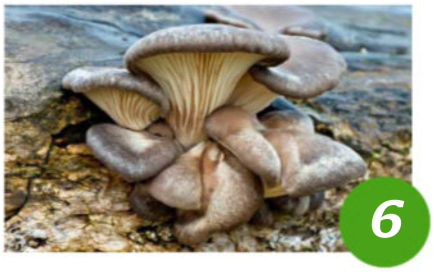
Have you ever spotted 'ice pancakes'?

ABOUT THE AUTHOR

Ben Hoare is a wildlife writer, editor and all-round 'nature nerd'. He also writes highly acclaimed illustrated natural history books for children.

Pretty boys

The screech of ring-necked parakeets has become one of most obvious wild sounds in London and several other UK cities. Though the non-native parakeets divide opinion, not least because they dominate birdfeeders, they make entertaining garden visitors.



Rise and shine

Greyish white oyster mushrooms can be seen on tree stumps and dead trees throughout the winter – in fact, cold weather often seems to produce more of them. The species is edible, and delicious, but it's never advisable to forage fungi unless with an expert.

Looking up

Bright yellow hazel catkins are welcome heralds of spring. A promise of warmer days to come, they are the tree's pollen-bearing male flower spikes and appear long before the leaves have unfurled, looking glorious against an azure blue February sky.

HOAR FROST: IAN WEST/ALAMY; ICE PANCAKES: ALAMY; RING-NECKED PARAKEETS: GEORGETTE APOL/ALAMY; OYSTER MUSHROOMS: BRIAN HIRD/ALAMY; HAZEL: ALAMY

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OPINION

GILLIAN BURKE

"The leaves look as if they've been sprinkled with pouting lips"

"One bottle of clear nail varnish, one roll of sticky tape and a glass slide are all that's needed to explore the enchanting and otherworldly landscape of a leaf. (Not forgetting a bog-standard light microscope, of course.)

The simple and satisfying process starts with dabbing a thumbnail-sized section of leaf with a thin layer of nail polish. Once dry, a strip of sticky tape is layered over it and then peeled off. With luck, the varnish will come away with the tape, carrying a perfect imprint of the leaf's surface.

Under the microscope, a lunar landscape is revealed, pock-marked with craters called stomata. Strangely uniform in shape and size, each opening is flanked by two plump 'guard cells' that, like a surreal work of art, make the leaf's surface – as well as that of stems and other above-ground structures – look as if they've been liberally sprinkled with hundreds, even thousands, of pouting lips.

Stomata control the entry and exit of gases in the leaf by swelling or deflating the guard cells. When the guard cells swell, the stomata open and carbon dioxide can be drawn from the air for use in photosynthesis, so the plant can stay alive.

These special pores first appear in the fossil record more than 400 million years ago, and recent evidence points to a single branch where all land plants bearing stomata diverged, with only the liverworts and some mosses subsequently 'opting out'. But for the vast majority of plant species that have retained stomata, little has changed in an evolutionary version of 'if it ain't broke, don't fix it'.

While the structure and function of stomata have held steady over evolutionary time, one thing has changed, and in a relatively short amount of time. Rising levels of carbon dioxide in the atmosphere over the past 200 years of industrialisation have corresponded with a thinning density of stomata on a given plant surface – in other words, fewer 'mouths' are needed in a CO_2-rich, 21st-century atmosphere.

With much of our attention on how we can deploy plants – with their ability to lock carbon – in the fight against human-induced climate change, another vital process is often overlooked, and that is transpiration. It's the poor cousin to 'carbon-busting' photosynthesis, but just as important.

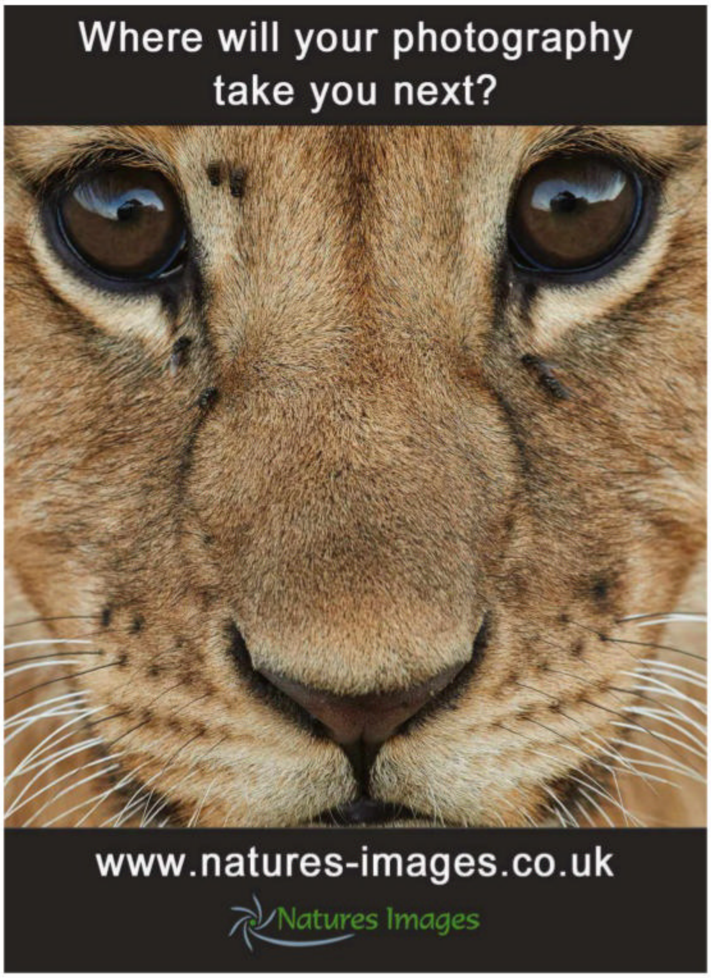
Being open to the outside world is great for drawing in carbon dioxide, but not great for conserving water, so stomata do another vital job in regulating water loss. The process of transpiration draws water and nutrients from the roots to the whole plant, while also serving as a cooling system for the leaves by releasing water vapour (the sun's heat being the downside to optimising for receiving sunlight). A single mature tree in leaf can release as much as 500l of water on a single sunny day, while even an uninspiring monocrop of corn can release up to 15,000l of water per acre each day.

Collectively, in city parks and tree-lined avenues, these micro-misters can counter the urban heat island effect. As water evaporates, heat is removed from the air, lowering the ambient temperature by as much as 5-8 degrees. Scaled up across a forest landscape, trees and other plants are literally rainmakers. It's estimated that nearly 20 per cent of the average annual precipitation that falls on the Earth's land is courtesy of plants and their stomata.

Climate change is often viewed through the lens of a carbon balance sheet, but we would be wise to remember that plants, together with their tiny gatekeepers, are more than carbon stores – they are living, breathing, climate co-creators.

Gillian Burke is a biologist, writer, film-maker, TV presenter and podcaster. She joined the BBC Two *Watches* team in 2017.

NINA CONSTABLE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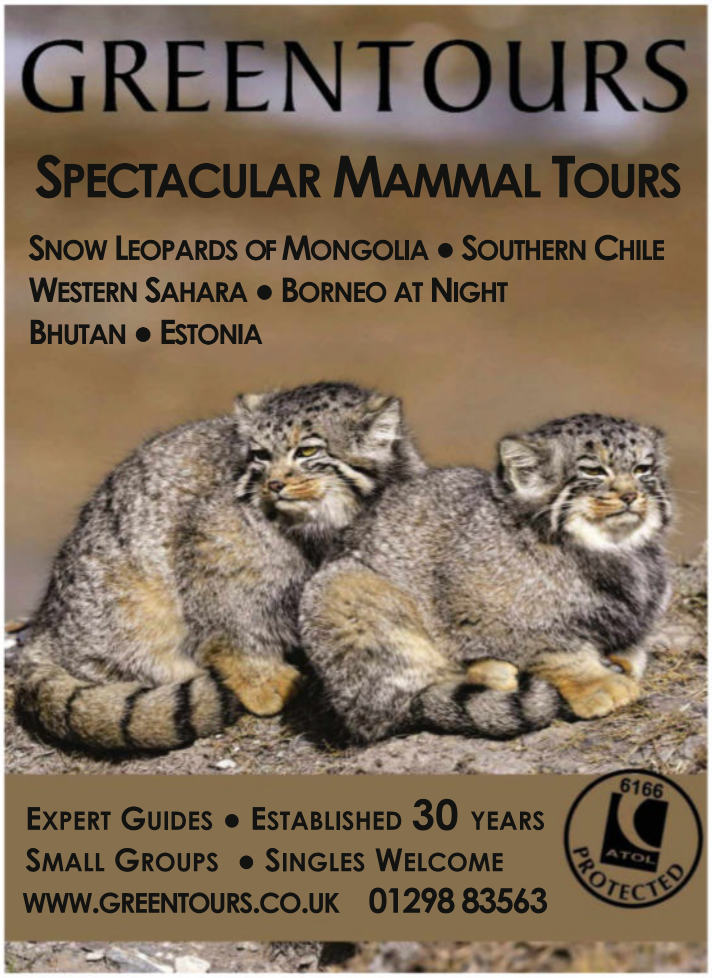
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FEMALE OF THE SPECIES

GREAT TINAMOU

It pays not to put all your eggs in one basket

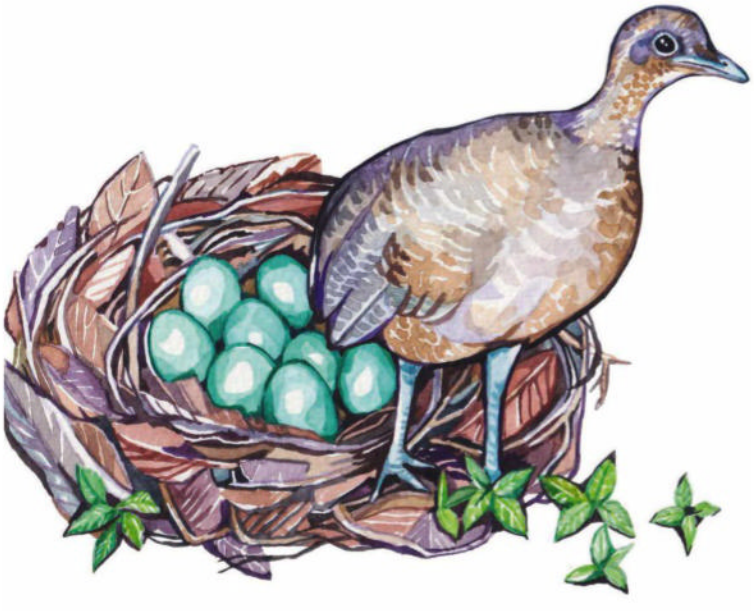
AT FIRST GLANCE, the great tinamou (*Tinamus major*) seems a candidate for nature's worst mother. After a fleeting liaison, this tropical bird abandons her eggs on the forest floor, leaving the father to do all the caretaking while she waltzes off to mate with another male.

Tinamous are ground-dwelling junglefowl found in the forests of Central and South America. Resembling big brown quails with tiny shrunken heads, they blend into the leaf litter – a logical adaptation, since the forest floor is teeming with predators. What's puzzling is why such an artfully camouflaged bird lays lurid turquoise eggs – which positively pop in their dark surroundings – and leaves the male alone to protect them.

Birds normally go to great lengths to safeguard their chicks. Some, such as the stork, nest high up, out of reach of most predators. Others, such as the robin, choose subterfuge, secreting their young away in heavily concealed locations. Those that nest on the ground, such as lapwings, generally produce camouflaged eggs and employ both parents as guards.

The female tinamou's habit of dumping DayGlo eggs in a pathetic nest and leaving dad to do the rest appears to be a recipe for extinction. Yet tinamous are one of the oldest bird families, and the only one in which all 46 species exhibit male-only care. More curious still, these diligent single dads appear to have been cuckolded.

Studying great tinamous in Costa Rica, scientist Patricia Brennan discovered that 60 per cent of clutches and 24 per cent of chicks were not even sired by the male doing the care. Females were, in fact, mating with multiple partners and dumping eggs in all their nests, creating a muddled paternity that further defies evolutionary logic.



Laying blindingly obvious eggs may seem an evolutionary fail, but there's method in the madness of those startling hues

Because standard Darwinian theory predicts that solo-male care should only evolve when males have a high certainty of paternity, Brennan assumed she'd made a mistake. Yet, double-checking her lab work, she found she was right – and wondered how the female was getting away with it.

If paternity is as important to tinamous as it is to evolutionary biologists, one would expect the male to evolve a way of detecting and ejecting foreign eggs. But as Brennan discovered, the male tinamou has no such skills. To do her paternity testing, she had to remove real eggs and replace them with fake ones. The males continued to incubate the bogus clutch regardless. Then, when the chicks hatched in her lab, Brennan would merge them with existing broods in the forest. Again, the males didn't care. "They didn't have any kind of recognition mechanism. That says a lot about how important it was for them," she told me.

That was her lightbulb moment. She set up cameras on the tinamou nests and recorded a whopping 80 per cent of the eggs being eaten by predators, mostly snakes. Brennan realised that the best way for both females and males to maximise their chicks' survival was to spread their bets across multiple nests. A case, quite literally, of not putting all your eggs in one basket.

This intentional mix-up also explained the eggs' lurid colour. Their gaudiness is a visual signal to other females to lay their eggs there. Brennan observed that snakes only ate a maximum of three eggs at a time. So, the bigger the brood, the better the chance of some eggs surviving.

Her research, then, not only rescues the great tinamou from being deemed a paradoxical parent, but also demonstrates that the concept of being a good mother can take many forms.

Lucy Cooke is a broadcaster, zoologist and author of *Bitch: What Does It Mean To Be Female?* (The Penguin paperback is on sale now)

BBC SOUNDS

Catch up with Lucy's three-part BBC Radio Four series, *Political Animals*

ILLUSTRATION BY HOLLY EXLEY

Even when not killing foxes, hunts cause disturbance to rural wildlife and livestock

GRAEME ROBERTSONGETTY

OPINION

“Throughout the winter, hunts up and down the country will be sticking two fingers up at the law”

MARK CARWARDINE

Fox hunting is illegal. I may be stating the obvious, but ‘illegal’ means it’s against the law – like smuggling heroin or stealing a car – and therefore you’re not allowed to do it. So how come last week hunters on horseback accompanied by a pack of baying hounds chased a fox right past my village? Throughout the winter, hunts up and down the country will be sticking two fingers up at the law and purposely setting packs of dogs onto foxes for ‘sport’.

Don’t let anyone tell you otherwise. Despite all the claims and protestations of the hunts, there is so much evidence – video footage, firsthand observations, secretly recorded conversations and comprehensive scientific reports – that even the police openly acknowledge that fox hunting is still common practice. England’s most senior police officer dealing with illegal hunt activity, chief superintendent Matthew Longman, put it perfectly: “It is fast becoming one of the most farcical eras in criminal justice history,” he says, “because hunts are still offending. We see it regularly.” It’s wildlife crime, plain and simple.

> **“There is so much evidence that even the police acknowledge that fox hunting is common practice”**

The Hunt Saboteurs Association goes further, describing fox hunts as organised crime gangs (claiming that many wield intimidation and violence towards anyone who gets in their way).

‘Trail hunting’ is the usual excuse (*see box*). But it’s utter balderdash. Hunts openly employ staff to block fox escape routes (including badger setts – which is also illegal). If the fox does find a hole, terrier men (who are armed with dogs and spades and accompany most hunts) put their terriers down to flush it out. There are hundreds of photographs and hours of video footage online of hunters grabbing these foxes and literally throwing them to the hounds, while the hunters jeer and laugh as the hapless creatures are ripped to shreds.

Fox hunters masquerade as noble, traditional and worthy. They argue that their barbaric bloodsport should continue because it is a British tradition (but then so was bear baiting). They claim that ‘country folk’ support fox hunting. But it’s simply not true – polls carried out for the League Against Cruel Sports in 2024 tell us that 70 per cent of rural voters want to get rid of this vile activity.

What normal, caring, intelligent, decent person would support such animal cruelty? In truth, it’s only a very, very, very small minority who enjoy watching traumatised foxes being ripped apart by a pack of bloodthirsty hounds. (My idea of normal, caring, intelligent, decent people are the kind who devote their lives to looking after injured and sick foxes, nursing them back to health.)

Even without killing foxes, hunts ride roughshod over the countryside, frequently trespassing on nature reserves and private properties (in some cases, even killing domestic cats). There are growing concerns about public safety, too, with packs of hounds tearing across busy roads, railway lines and farmland.

What needs to be done? The National Trust, the Lake District National Park, Forestry England and Natural Resources Wales have all taken the matter into their own hands and banned or suspended trail hunting on their land.

AT A GLANCE

- Fox hunting has been illegal in Scotland since 2002 and in England and Wales since 2004. It is still legal in Northern Ireland.
- Overwhelming evidence, collated by the police, journalists, League Against Cruel Sports, Protect the Wild, the Hunt Saboteurs Association and many others, shows that fox hunting never stopped.
- The most common and effective way fox hunts have avoided prosecution is by ‘trail hunting’. This legal loophole allows them to lay a scent trail, typically using fox urine, for their hounds to follow.
- The reality of trail hunting was exposed in 2020, when senior hunt officials were caught on camera admitting that it is a smokescreen for the chasing and killing of foxes.

Scotland recently banned trail hunting under the Hunting with Dogs (Scotland) Act 2023 (although NatureScot has been issuing dozens of special licences for hunting with packs of dogs and it’s unclear how many of these have been used by hunts.) I believe that England, Wales and Northern Ireland should follow suit as a matter of urgency. We need proper deterrents, too. Currently, the only punishment for these criminals is a small fine (the average in 2023 was £356).

Unfortunately, previous governments have been on the side of the very, very, very small minority – albeit a well-connected minority. But perhaps the new government will do the right thing?

Want to comment?
Share your thoughts on Mark’s column by sending an email to wildlifeletters@ourmedia.co.uk

Mike Dilger's
WILDLIFE SPECTACLES

The broadcaster, naturalist and tour guide shares the most breathtaking seasonal events in the world

LIFE'S A BEACH

ORCAS HUNTING SEALIONS

These impressive predators launch themselves from the surf in a spectacular hunting strategy

Being both an apex predator and a charismatic beast, the orca, or 'wolf of the sea', must surely figure highly on most wildlife-watchers' bucket lists. The orca is a cosmopolitan species and swims in all oceans, but is most abundant in colder, temperate waters. Spotting these giants is rarely straightforward, however, and just the sight of that huge dorsal fin slicing through the water might arguably be considered a spectacle in its own right.

Anyone keen to go a step further and witness orcas at their destructive best will need to head to just a couple of locations on the coast of Argentina, between February and late April (the austral autumn). With the requisite patience and luck, you might have the opportunity to observe these apex predators hunting in a manner requiring a level of intelligence, adaptability and organisational propensity that almost defies belief.

It's a strategy known as 'intentional stranding', and entails the orcas temporarily beaching themselves in an attempt to snatch South American sealion pups from the shoreline. When this remarkable hunting behaviour was shown on television for the first time in the 1990 BBC series *Trials of Life*, it sent waves around the nature-loving world.

Those teeth are not for chewing

Did you know?

Orcas have a bite force of around 19,000 pounds per square inch (psi), the strongest of any animal. To put this in perspective, the great white shark's bite force is 4,000psi and a human's a feeble 160psi.

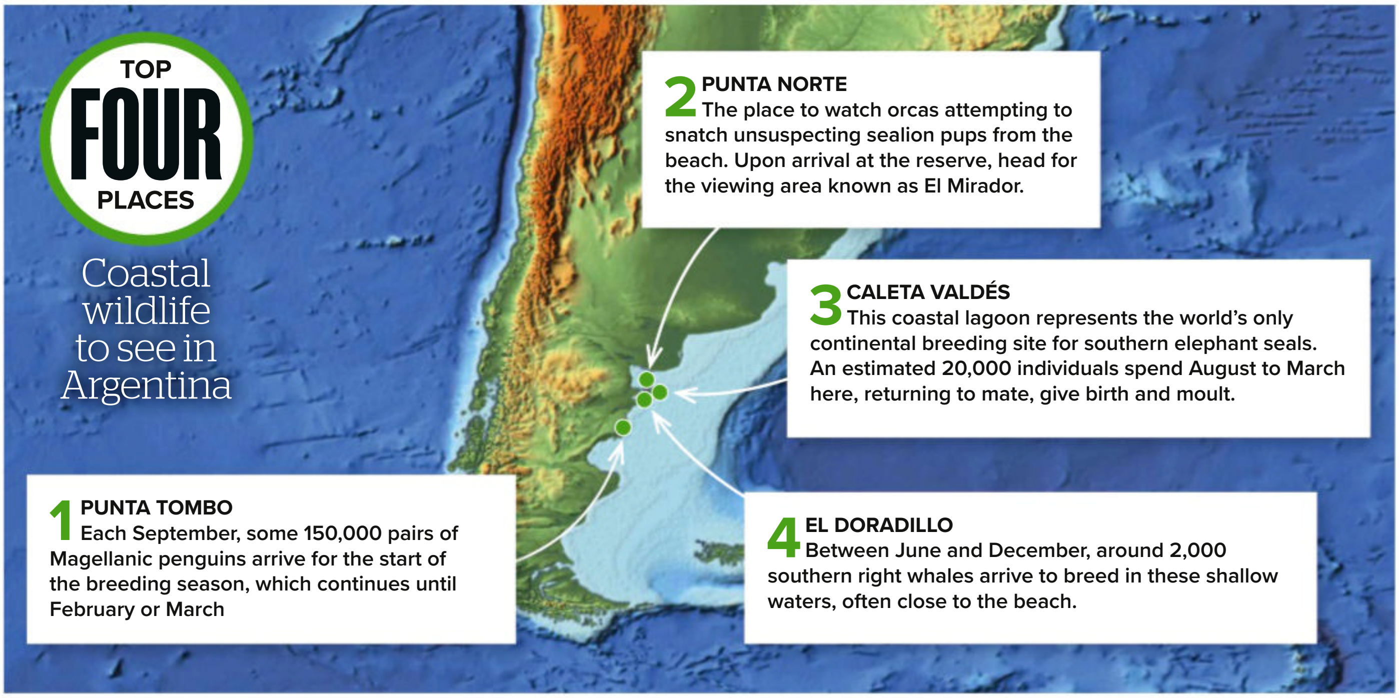
As the hulk of an orca looms from the shallows, this young sealion will be lucky to escape

BEACHING ORCA: SYLVAIN CORDIER/NATUREPL.COM; ORCA TEETH: ALAMY

“Hit-rates for experienced orcas have been calculated at around 50 per cent”

TOP FOUR PLACES

Coastal wildlife to see in Argentina



1 PUNTA TOMBO
Each September, some 150,000 pairs of Magellanic penguins arrive for the start of the breeding season, which continues until February or March

2 PUNTA NORTE
The place to watch orcas attempting to snatch unsuspecting sealion pups from the beach. Upon arrival at the reserve, head for the viewing area known as El Mirador.

3 CALETA VALDÉS
This coastal lagoon represents the world's only continental breeding site for southern elephant seals. An estimated 20,000 individuals spend August to March here, returning to mate, give birth and moult.

4 EL DORADILLO
Between June and December, around 2,000 southern right whales arrive to breed in these shallow waters, often close to the beach.

The best known location to observe beaching orcas is Península Valdés, specifically at Punta Norte, which also happens to be the pupping site for around 3,000 South American sealions.

The youngsters are born in mid- to late January, which means that by late February, the shoreline is alive with nurseries of sealion pups both frolicking in the shallows and learning how to swim. Precisely where the orcas go when not taking advantage of this seasonal bounty is still unclear, but they probably spend most of their time in deeper waters along the Atlantic seaboard.

The orcas' favourite time slot for hunting tends to be a couple of hours either side of high tide, when a combination of the elevated water levels and the beach's steeper profile allows them to temporarily approach within sniffing distance of the pups while crucially remaining in sufficiently deep water. The orcas appear less willing to hunt during strong winds, as the ensuing larger waves could force them too high up the beach to facilitate an easy return to the water. There is also anecdotal evidence from researchers at Punta Norte that the orcas listen for the sounds of pups calling from the water's edge, so wild and windy weather conditions may impede their ability to pinpoint the precise location from which to mount an attack.

At Punta Norte, an orca uses its tail to flip a sealion high out of the water

> "Any pup seized has little chance of escape before being put out of its misery"

When in hunting mode, an orca often swims on its side to hide its distinctive dorsal fin from its quarry on the beach. Once the sealions are within lunging distance, the predator exploits the thrust of a wave by swimming along at a high enough speed to propel its huge body out of the surf and onto the shore. High – but not quite dry – it attempts to grab an inattentive or unaware pup.

Orcas possess powerful jaws packed with conical, interlocking teeth, so any victim has little chance of escape before being put out of its misery, shaken and tossed around like a rag doll. With its meal duly gulped down, the orca then thrashes its own body in expectation of the next large wave that will carry it back to the safety of the deep.

So successful is this technique that researchers have calculated hit-rates for experienced orcas to be around 50 per cent. Even more remarkable is that this hunting tradition appears to be passed down the generations, with youngsters receiving masterclasses from their mothers in the art of beaching and snatching. Impressive doesn't even come close.

LOOK CLOSER

What's in a name?

The orca's alternative name of 'killer whale' derives from the original name 'whale killers', coined by Basque sailors who observed the predators hunting whales. Somehow, the two words became transposed in translation and 'killer whale' stuck. 'Orca', now more commonly used, emanates from the scientific name *Orcinus orca* – '*Orcinus*' meaning 'kingdom of the dead'.

Slow breeders

While orcas are thought to produce young every three to 10 years, those visiting Valdés have much longer gaps between offspring. This is thought to allow the mothers more time and energy to teach calves the skills needed to execute the stranding technique.

Elephant eats

Elephant seal pup

The elephant seal pups at nearby Caleta Valdés learn to swim in the shallows between October and December, giving the orcas valuable practice for sealion season a few months later.

NEXT MONTH

Common cranes dancing their way back into Britain

ORCA FLIPPING SEALION: GABRIEL ROJO/NATUREPL.COM; SOUTHERN ELEPHANT SEAL PUP: KATHRYN JEFFS/NATUREPL.COM ; COMMON CRANE: ALAMY

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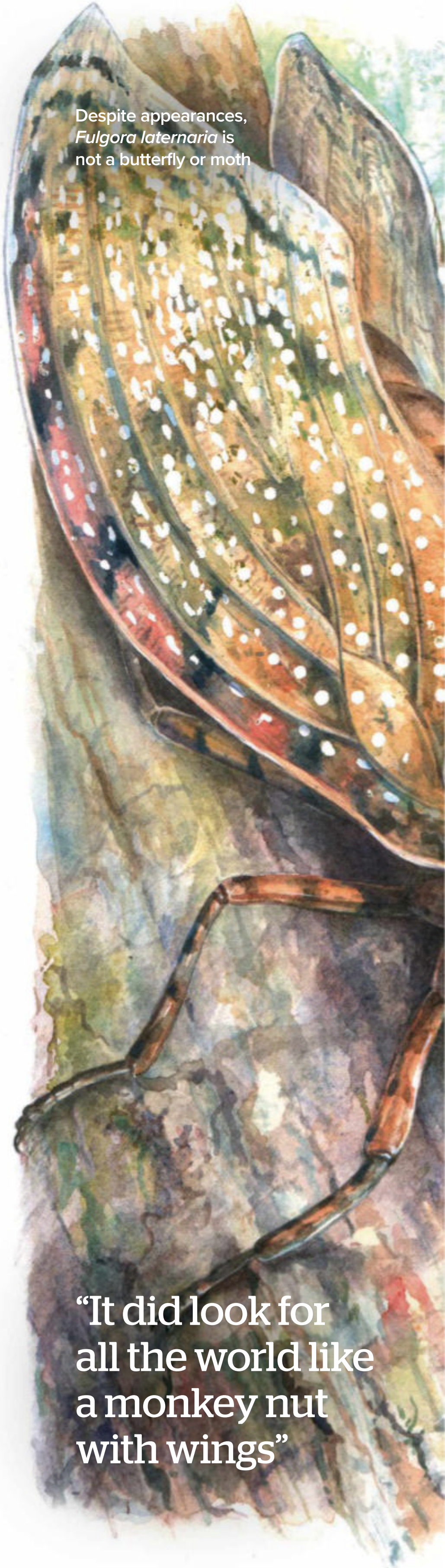
LANTERN BUG

Its hefty headgear has garnered this sap-sucker mythical status



Despite appearances, *Fulgora laternaria* is not a butterfly or moth

A MID THE BUSTLING CORNUCOPIA OF tropical life and the metallic flashes of beetles and butterflies, it sat statue still. It hadn't been there the night before as I walked to and from my rainforest lodge. Having only seen pictures or dreary museum specimens, it was my first live encounter with this strange, little-understood icon of the tropics, and nothing could quite prepare me for the real deal.

Fulgora laternaria has many monikers – lantern bug, lanternfly, machaca and alligator bug, to name a few. Mine was perched at head height on a tree trunk, and looking at it for the first time I was reminded of another popular and descriptive name for this insect: the peanut-headed bug. It did look for all the world like a monkey nut with wings, and one that had been generously sprinkled with icing sugar.

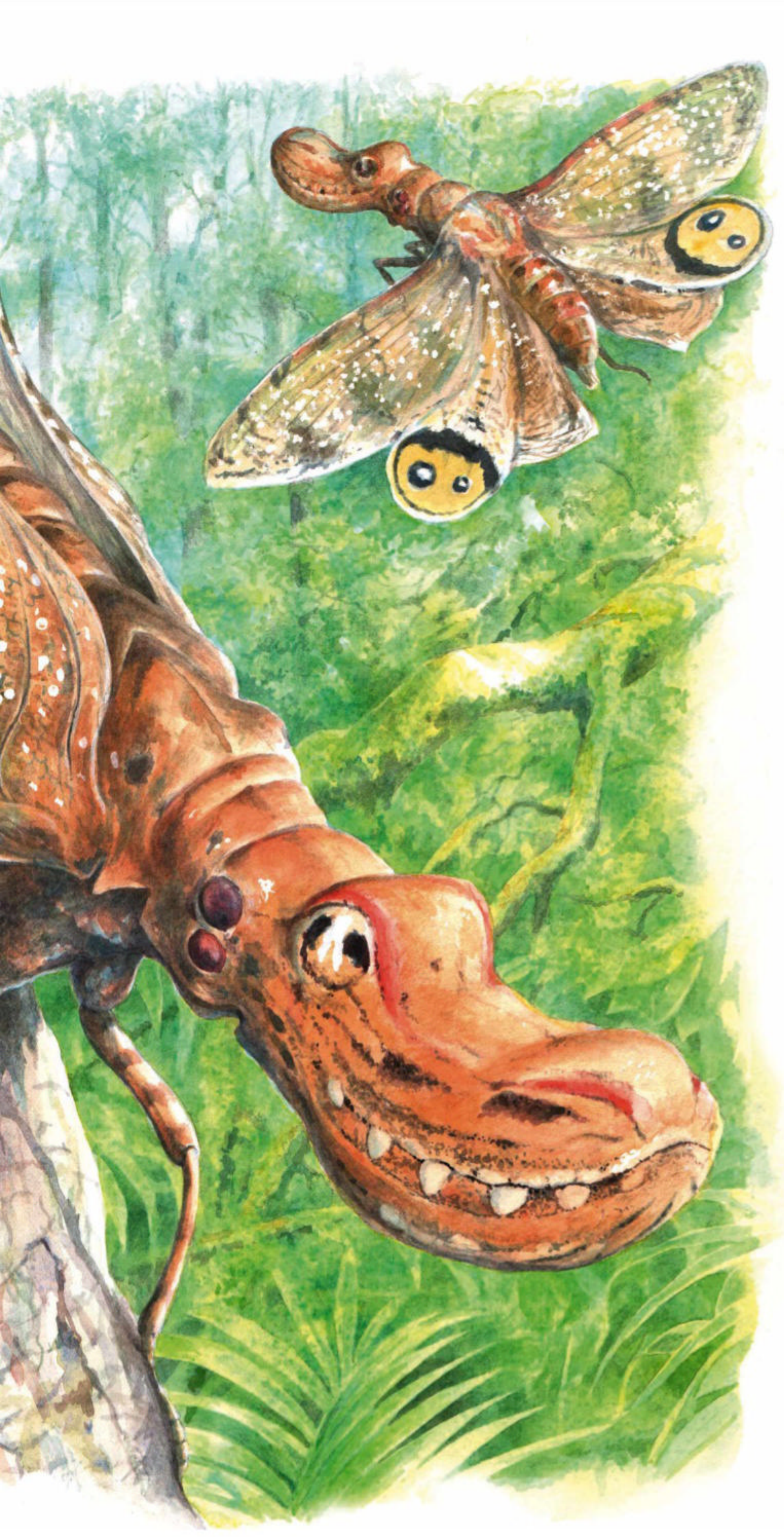
Throughout the tropics, many myths and legends surround the lantern bug. In Costa Rica, one story says that its 'peanut' is full of poison and can kill you if it bursts, the potency of the venom depending on the colour of its wings. According to another folk tale, if you're stung, you must have sex within 24 hours or you'll die – a myth probably invented and perpetuated by lovesick boys. The bad news for the boys is that this insect is harmless and doesn't contain a drop of venom, let alone the sting to deliver it.

In fact, the lantern bug is a peace-loving sap-sucker, belonging to the 'true bugs' order (called Hemiptera) along with its more familiar cousins – cicadas, shieldbugs and planthoppers. Hidden away and somewhat overshadowed by its outlandish headwear is the tool of its trade: a stout, sharp-tipped, hollow straw of a mouthpart, which the lantern bug uses to penetrate a plant's tissue to extract the phloem, its sweet lifeblood.

The lantern bug's unremarkable lifestyle is matched by a fairly straightforward life-cycle. Tiny, dark replicas of the adults hatch from a spongy egg mass and progress through several nymphal stages, sucking sap all the way, until their final moult into the spectacular adult insects – just like the one sitting on the tree trunk that day.

Given its tame, pastoral existence, quietly sucking sap, the lantern bug's mythological status is simply down to its

> "It did look for all the world like a monkey nut with wings"



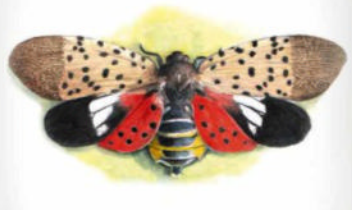
incongruous appearance. But what is the purpose of its fanciful, flamboyant head nut? The truth is nobody really knows.

Many of the other lantern bug species in tropical regions around the world have equally ludicrous protuberances. Some are brightly coloured and it is thought this might be a warning of unpleasant chemicals within their bodies. There is also the idea that their odd profile makes them look threatening or hard to swallow and, in some cases, acts as a form of camouflage. There's even a theory that they knock their hollow heads against bark to communicate with others perched on the same tree. After all, some of their relatives are known to use a similar method of audio communication.

The markings on the head extension of *Fulgora laternaria* bear a striking resemblance to those found on a lizard's head, which could well suggest it acts as a deterrent. Even more alarming for a would-be predator, it takes little more than a tap for the lantern bug to realise its ruse had been rumbled and for it to turn into something scarier. With a slight twitch, its wings flex to reveal startling bright eyespots on the hindwings. It's an old standard as far as insect defence strategies go, but if it's enough to make a naturalist start, then it's going to be very effective against a curious rodent or insectivorous bird.

Despite their name, lantern bugs do not light up. German entomologist Maria Merian seeded this misconception when she claimed the insects glowed enough to read by.

LOOK CLOSER



The spotted lanternfly

Spotted!

Another species that belongs to the same family as the lantern bug, Fulgoridae, is currently making headlines in the USA. The spotted lanternfly, introduced from Asia, is becoming an agricultural pest, particularly threatening vineyards. Their sap-sucking waste product, called 'honeydew', can cause a fungal disease.

ILLUSTRATIONS BY PETER DAVID SCOTT/THE ART AGENCY

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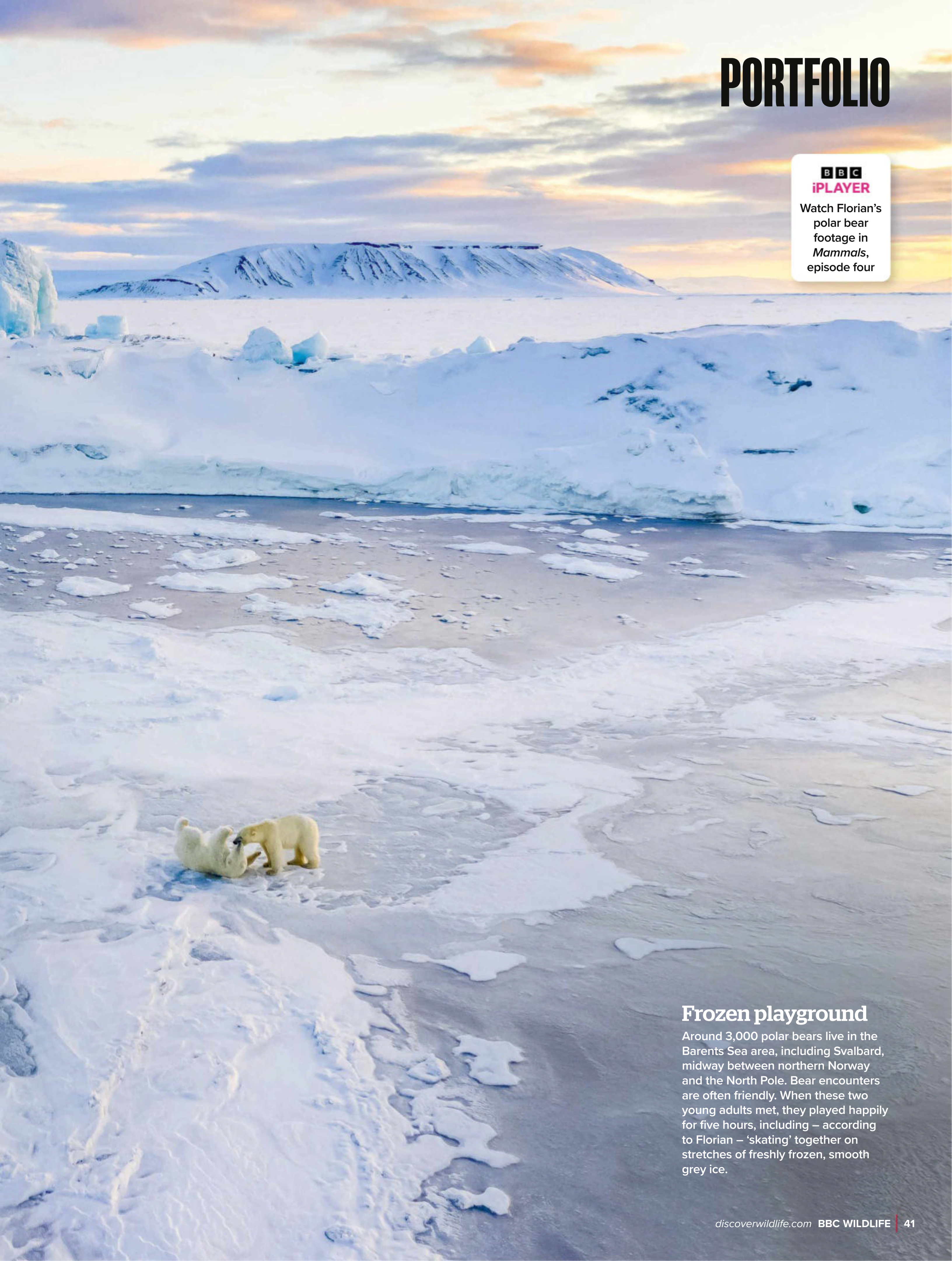
BBC wildlife

KINGDOM OF THE ICE BEAR

Powerful and ruthless, but playful and tender, the polar bears of Svalbard are as complex as they are beautiful, says photographer Florian Ledoux

Photos by **FLORIAN LEDOUX** *Words by* **JOE PONTIN**

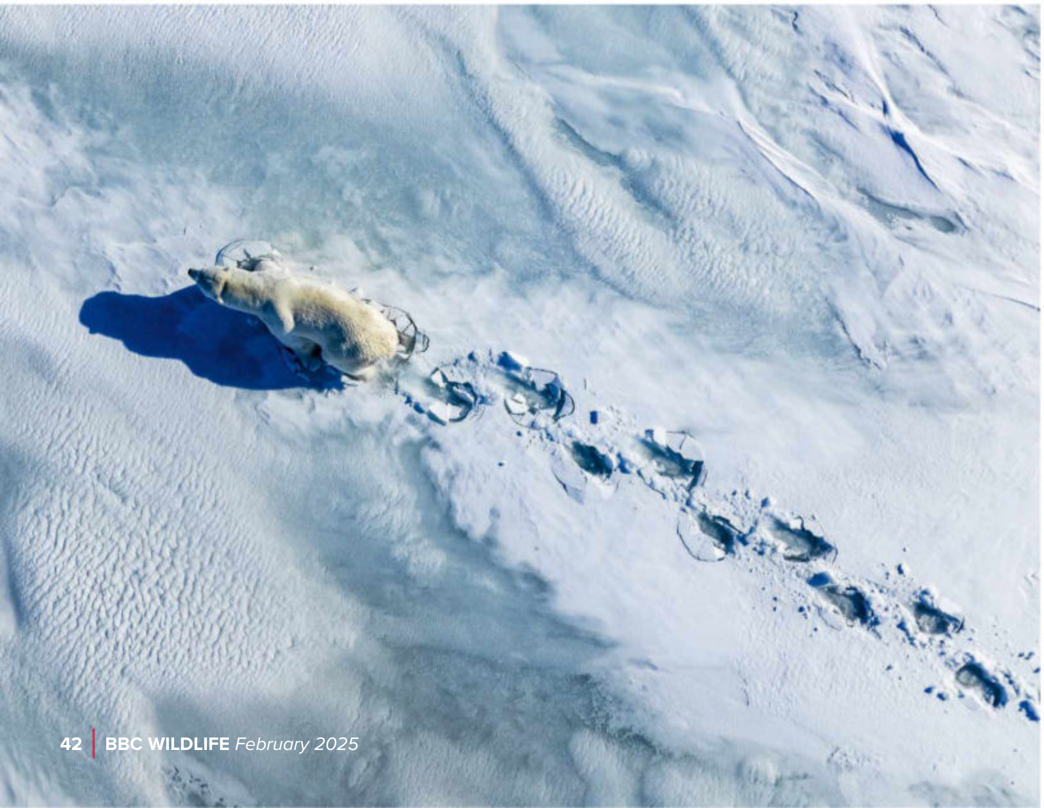


BBC iPLAYER

Watch Florian's polar bear footage in *Mammals*, episode four

Frozen playground

Around 3,000 polar bears live in the Barents Sea area, including Svalbard, midway between northern Norway and the North Pole. Bear encounters are often friendly. When these two young adults met, they played happily for five hours, including – according to Florian – 'skating' together on stretches of freshly frozen, smooth grey ice.



Family foraging

A female searches for prey to sustain her family. Cubs eat solid food from the age of three months, but mothers continue breastfeeding for another 16 months or more. Despite their efforts, Svalbard cubs have only a 35 per cent chance of surviving for two years.

Bigfoot trail

Adult males are roughly twice the weight of a grizzly bear and leave huge prints. Up to 30cm in diameter, their paws act like snowshoes, spreading the weight evenly over treacherous ice. “Late in May the ice is rotten so you get an even bigger footprint,” says Florian.

A moment of peace

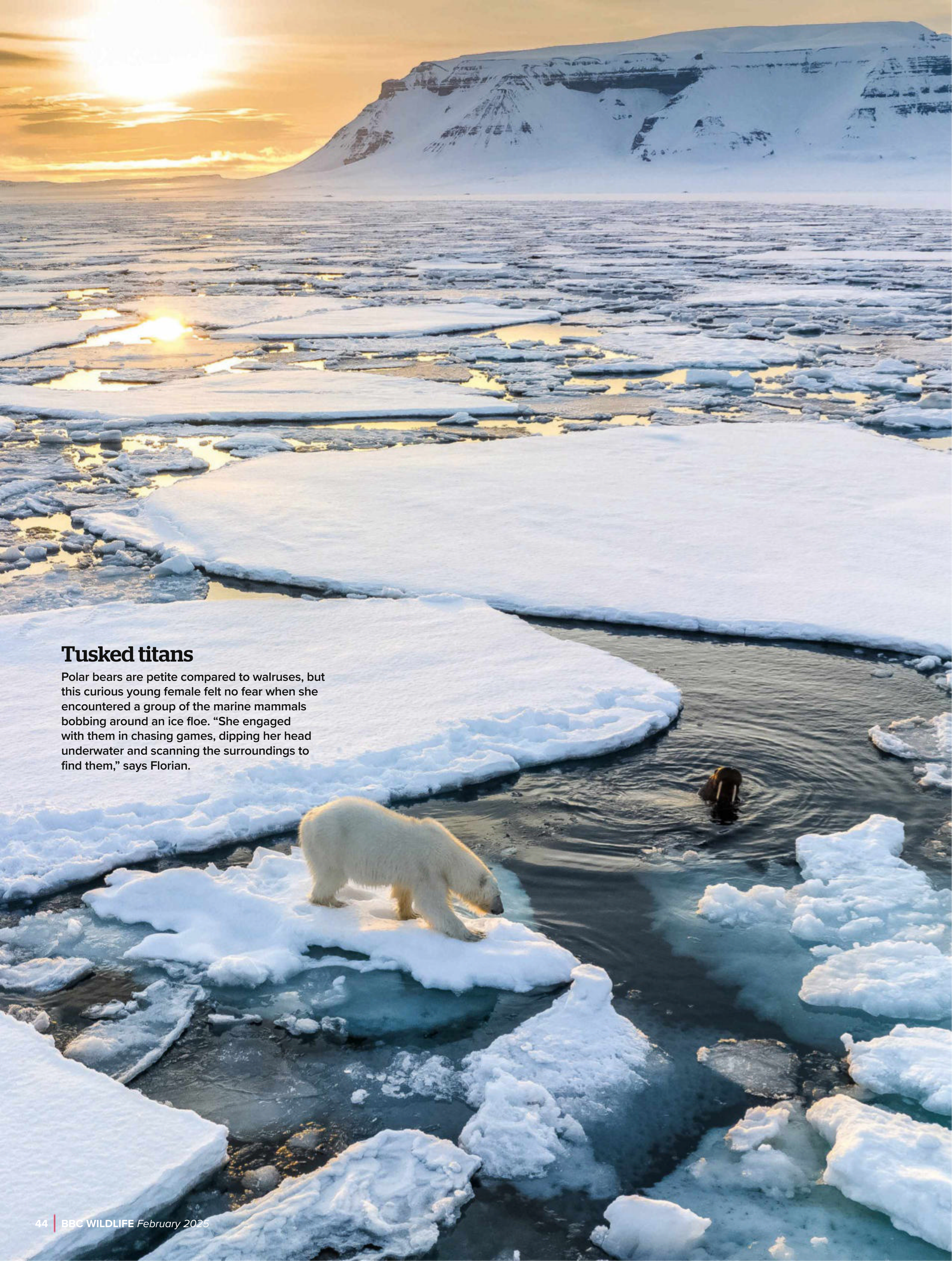
High on the mountain, two polar bears slumber after mating, a moment "so moving it brought tears to my eyes," says Florian. During courtship, the male may be domineering, excited and overheated, with frozen drool around his mouth; but sometimes the male is shy and the female takes the lead.

Waiting game

Svetlana, a two-and-a-half year old, stakes out a breathing hole, patiently awaiting her seal prey. The Svalbard bears' diet consists mainly of ringed seals, whose liver is rich in nourishing vitamin C – thought to protect the corneas of polar bears from snow blindness.

ABOUT THE PHOTOGRAPHER

Florian Ledoux is a French photographer and film-maker living in Norway. He is obsessed with the Arctic region and has worked on productions including Disney Nature's feature film *Polar Bear* and the BBC's *Frozen Planet II*.



Tusked titans

Polar bears are petite compared to walruses, but this curious young female felt no fear when she encountered a group of the marine mammals bobbing around an ice floe. “She engaged with them in chasing games, dipping her head underwater and scanning the surroundings to find them,” says Florian.

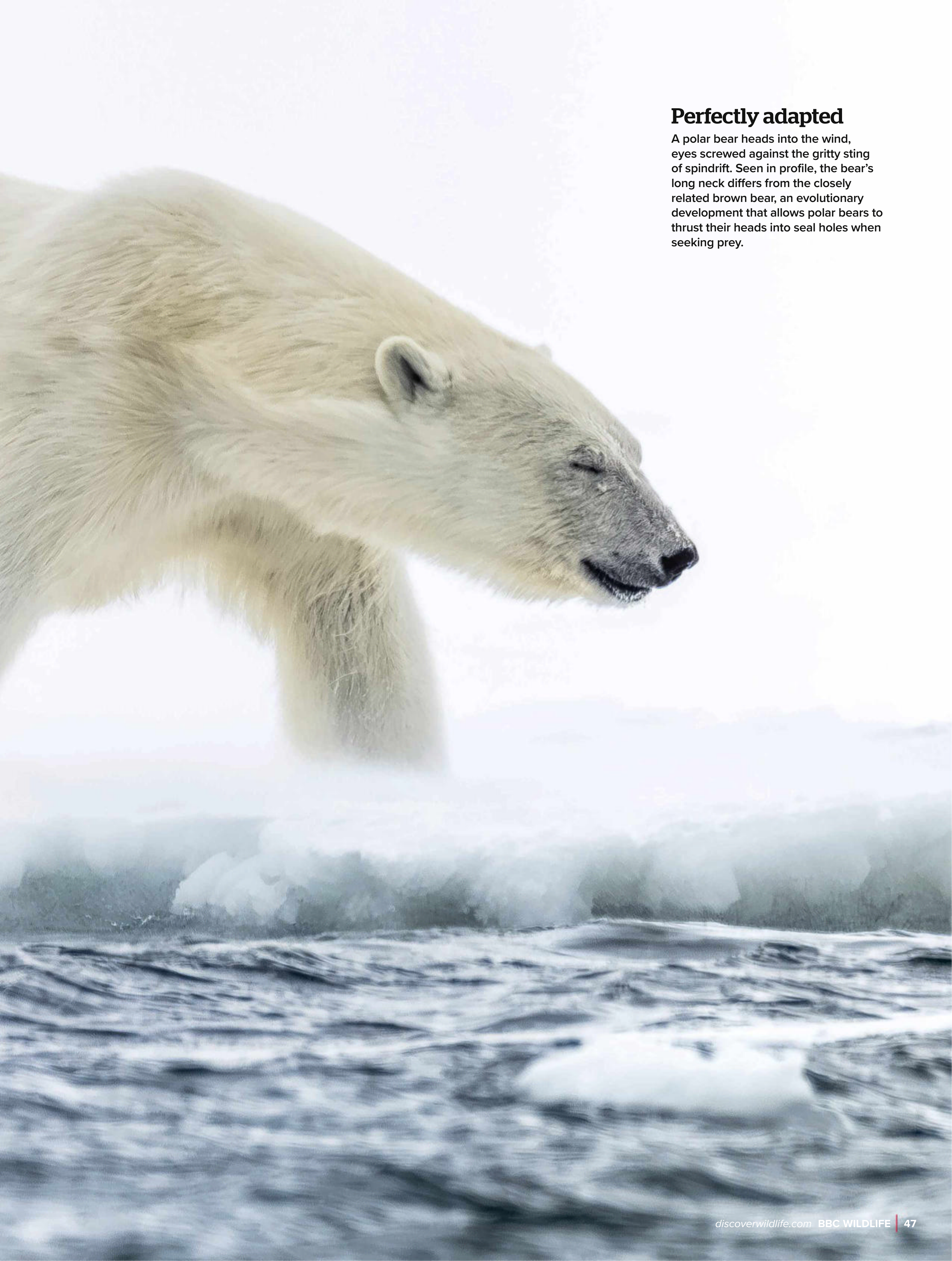
On thin ice

The Arctic is warming faster than anywhere else on the planet, and nowhere in the region is the sea ice retreating more quickly than in the Barents Sea around Svalbard. This polar bear is testing its weight on a thin layer of ice, an increasingly important survival skill.

Furry story

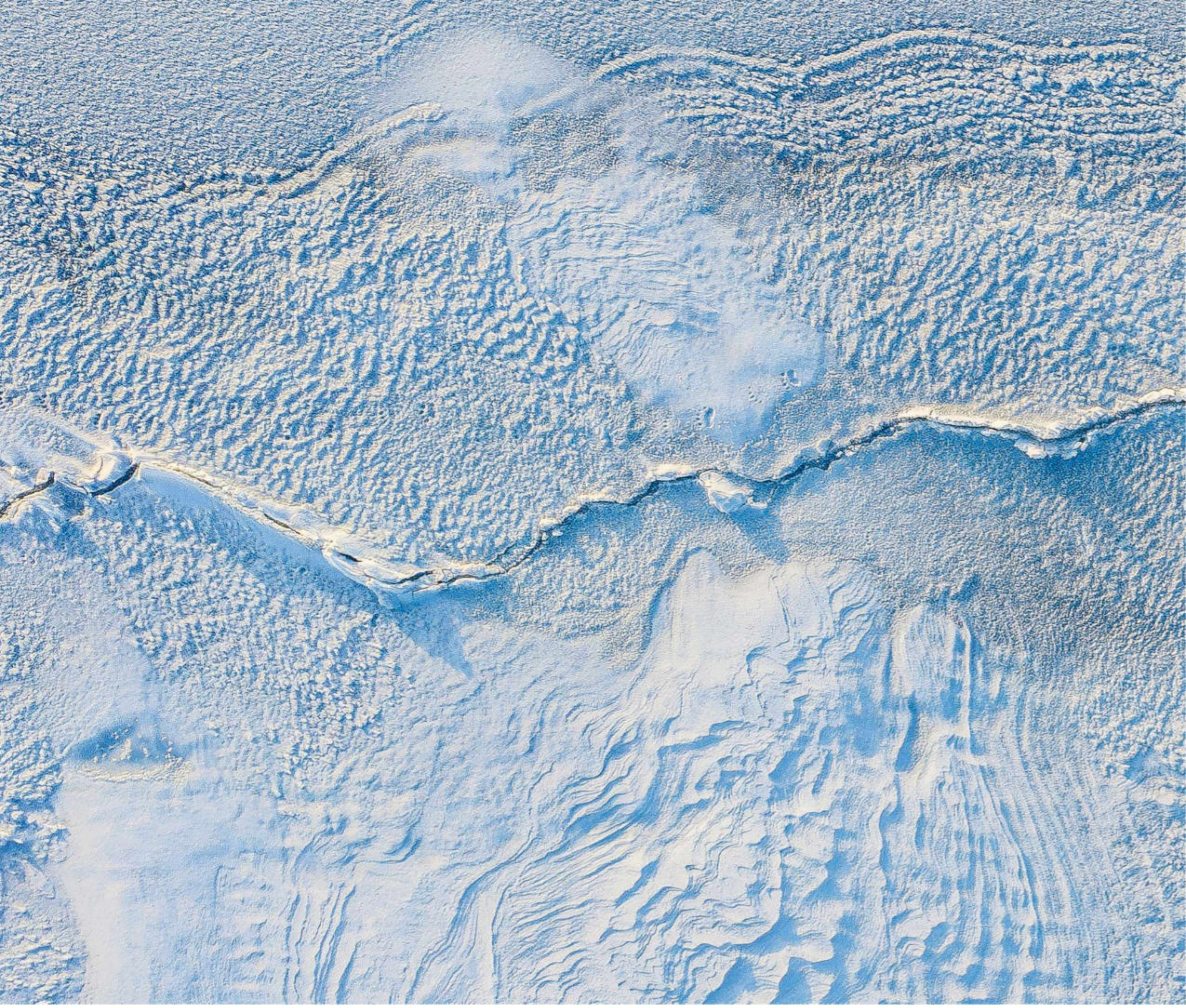
Polar bears have two layers of fur: an undercoat of thick, fine hairs, and a coarser 'guard' coat. The hairs of the latter are hollow, which helps with insulation and buoyancy. To protect them from the extreme cold, polar bears also need a layer of fat up to 11cm thick.

PORTFOLIO



Perfectly adapted

A polar bear heads into the wind, eyes screwed against the gritty sting of spindrift. Seen in profile, the bear's long neck differs from the closely related brown bear, an evolutionary development that allows polar bears to thrust their heads into seal holes when seeking prey.

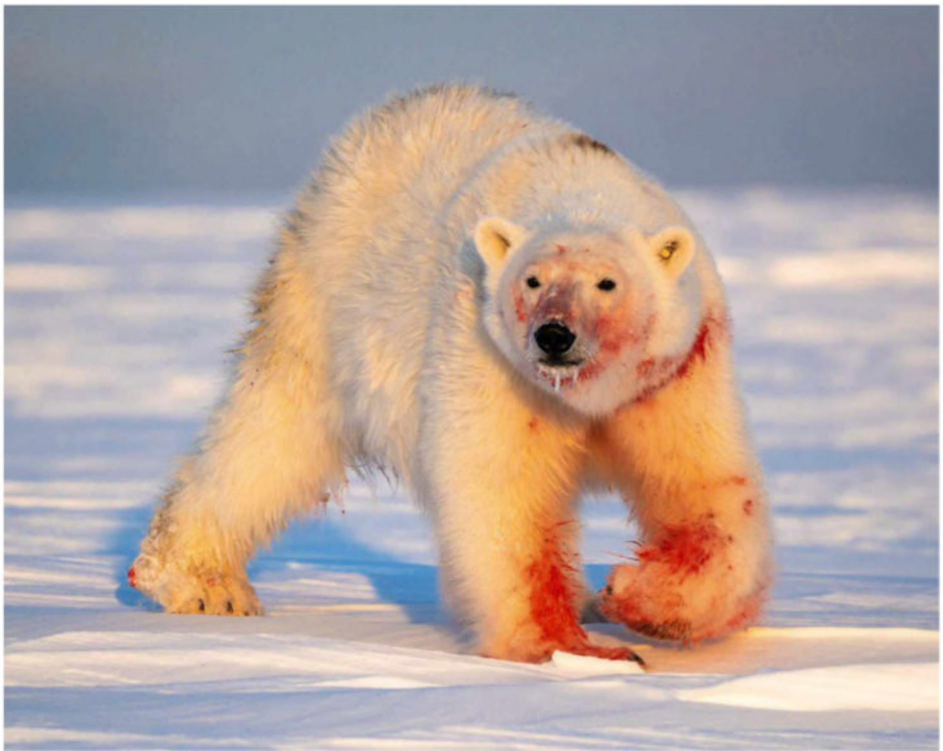


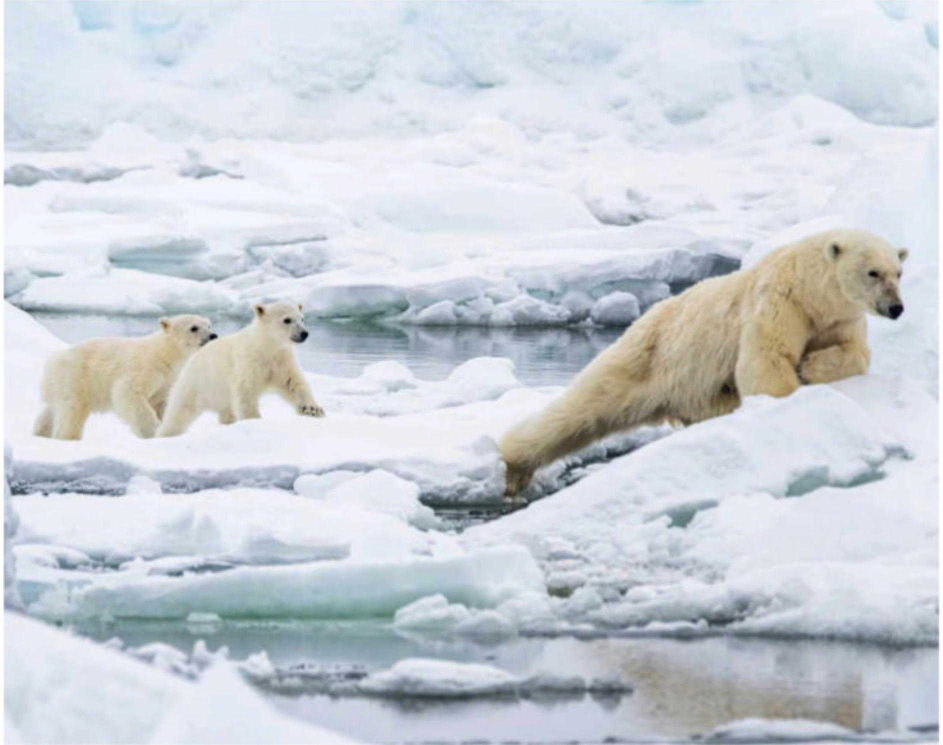
Nosing for supper

A mother leads her 15-month-old cubs along a great crack in the ice. "Bears always follow features in the ice, constantly smelling," says Florian. The bears know they may discover prey, because seals are often attracted to the pockets of space around cracks and other deformations in the ice.

Fast food

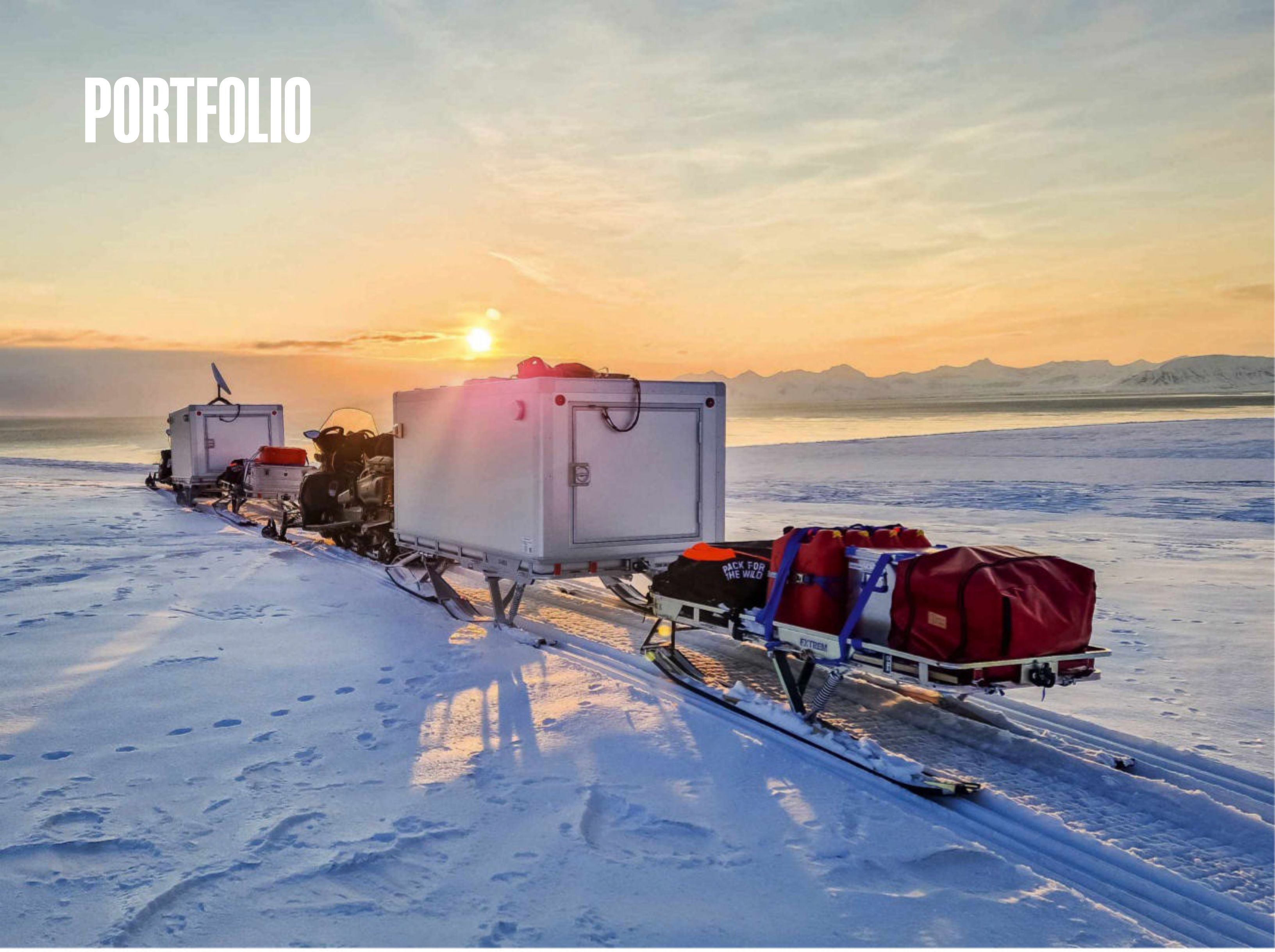
This female has just killed a reindeer, a behaviour unknown in polar bears until recently. Having left her family at a young age, she had to adapt. "The only thing she learned from her mother," says Florian, "was killing reindeer – running super-fast, for up to four minutes, like a lion hunting."

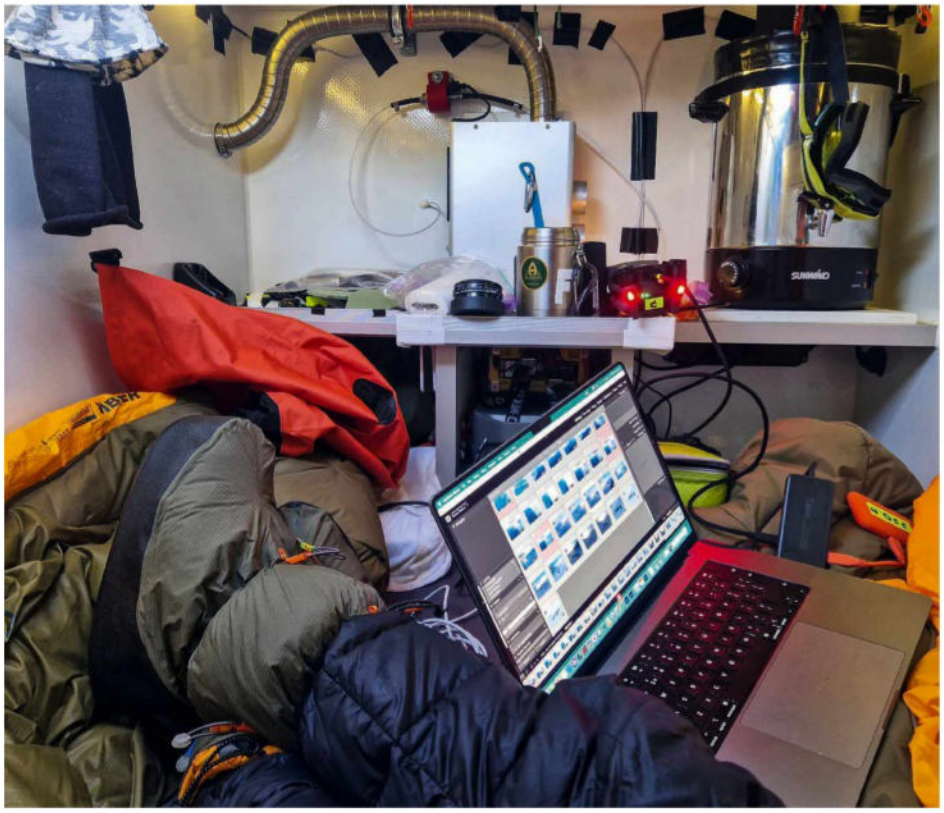




Balancing act

A mother of two young cubs spreads her weight over treacherous ice to reach a nearby seal carcass. “There was lots of chaotic ice, packed close and dense, and moving all the time from the storm and wind,” says Florian.



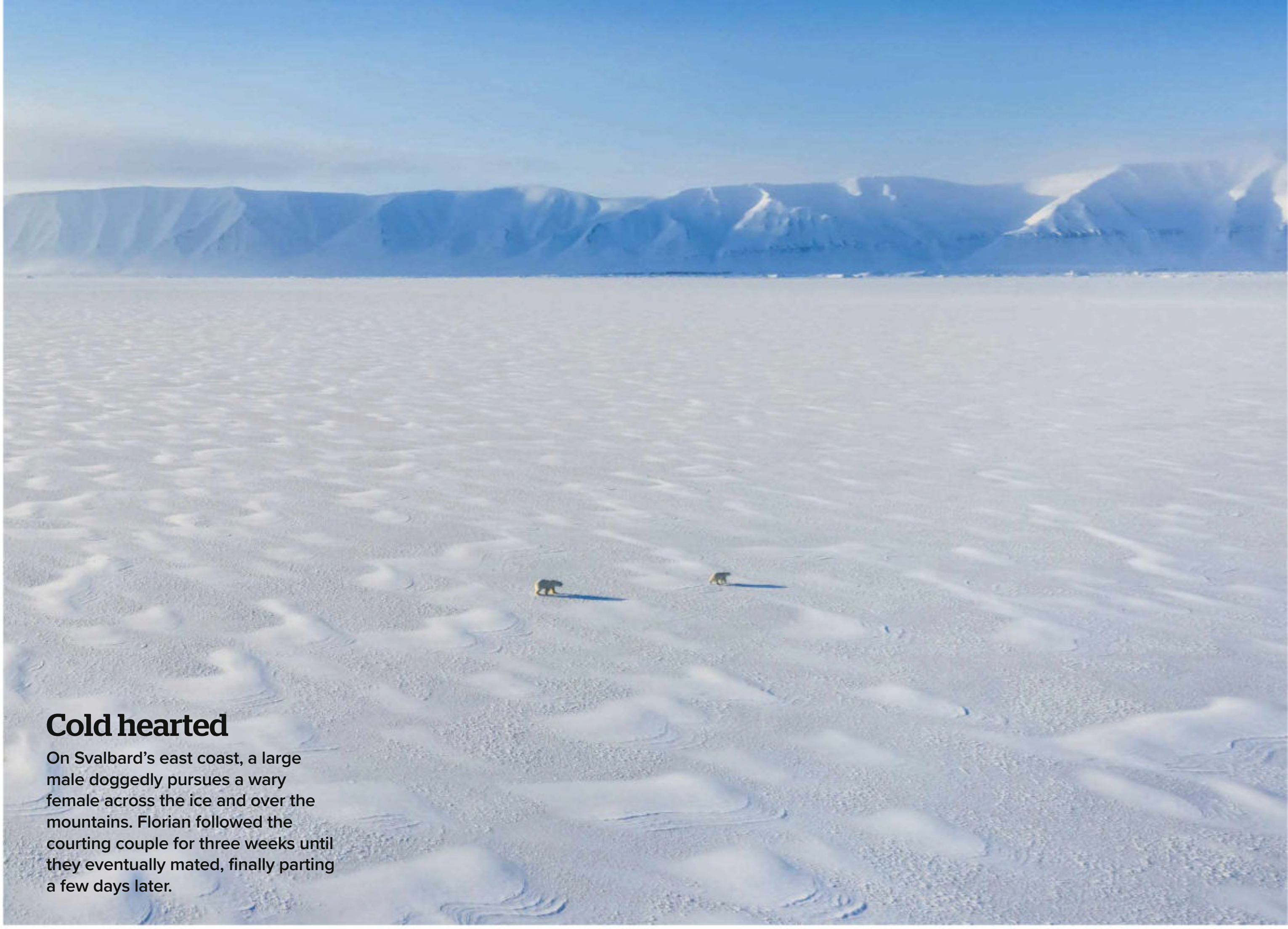


Mobile home

Each season, Florian spends a total of three and a half months on the ice, following the bears with his snowmobile and towing his shelter – essentially a heated box he calls the 'pod'. A pod measures 2m by 1.2m and can sleep two people. Either one or two pods can be taken on an expedition, depending on the project and size of the crew. "The pod is more than a logistical choice," says Florian. "It allows a full immersion in nature."

Domestic life

When on a photography shoot, Florian and his guide live in a pod for up to six weeks at a time, briefly returning to civilisation for a shower before heading back onto the ice. He uses his laptop to check weather reports and ice conditions. "We have the best internet – but we don't use it, because we want to live the experience."



Cold hearted

On Svalbard's east coast, a large male doggedly pursues a wary female across the ice and over the mountains. Florian followed the courting couple for three weeks until they eventually mated, finally parting a few days later.

Kill with kindness?

The bond between mother and cub can be strong – sometimes too strong, says Florian. This cub was still breastfeeding at the age of two and a half years. "To me it feels like [when they finally go their own way] the cubs that are too protected are more likely to die."

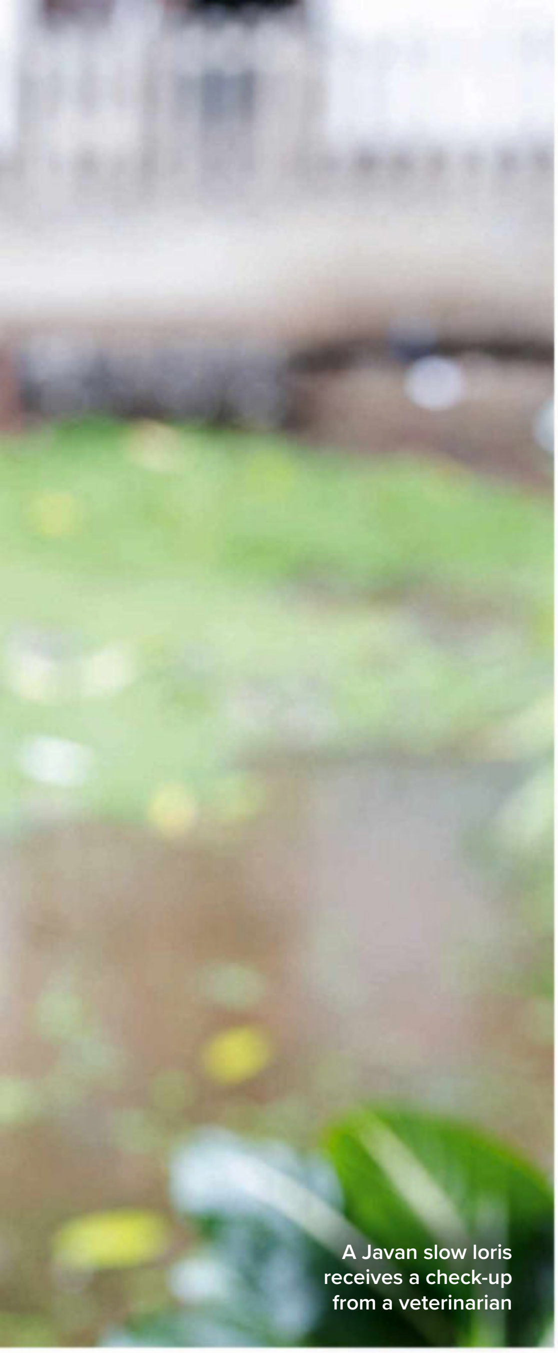
SLOW BUT SURE

The Javan slow loris has suffered a huge population decline in recent years. But conservation efforts are turning the tide for this fascinating animal.

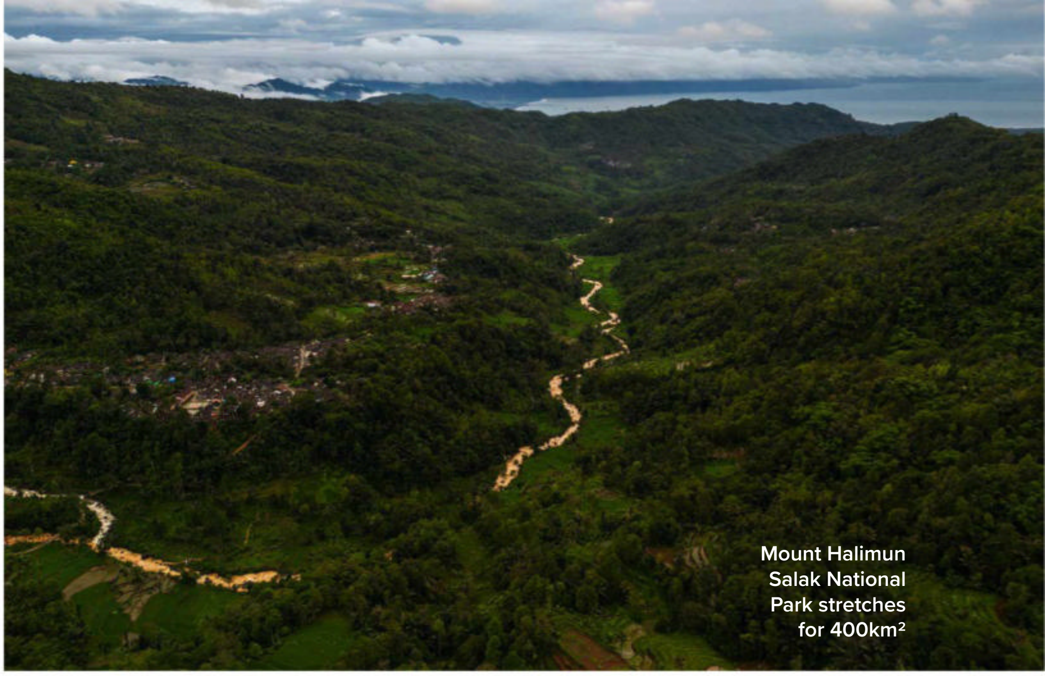
Words by **DANIEL ALLEN** *Photos by* **GARRY LOTULUNG**

A caged Javan slow loris prior to its release back into the wild in Mount Halimun Salak National Park

The Javan slow loris is not, as its name suggests, the speediest creature in the animal kingdom. These melon-sized mammals move at an average speed of around one mile an hour, while they can perch motionless on a branch for an entire morning or afternoon. Researchers believe they may even slip into torpor – a kind of hibernation – when it gets chilly.



A Javan slow loris receives a check-up from a veterinarian



Mount Halimun Salak National Park stretches for 400km²

The YIARI Primate Rehabilitation Centre, near the city of Bogor

Sadly, the recent decline in the Javan slow loris population has been anything but sluggish. With numbers plummeting by at least 80 per cent over the past three decades, the Javan slow loris is now one of the world's 25 most endangered primates. In Indonesia – which is home to the Javan slow loris and five other slow loris species – these omnivores are now in serious danger of extinction.

"With their doe-eyed, button-nosed faces and cuddly appearance, the Javan slow loris and other loris species are outwardly endearing," says Nur Purba Priambada, a wildlife veterinarian and animal management supervisor working for NGO Yayasan Inisiasi Alam Rehabilitasi Indonesia (YIARI). "Sadly, their very cuteness has been a major factor in their decline, because people want to keep them as pets. Efforts to address the illegal trade in slow lorises, which are critical to their conservation, are hopefully bearing fruit just in time."

THE MOST CAPTIVATING SLOW loris feature is their brown saucer eyes – an adaptation that facilitates their nocturnal lifestyle. The Javan slow loris, which is endemic to the Indonesian island of Java, spends most of the day asleep,

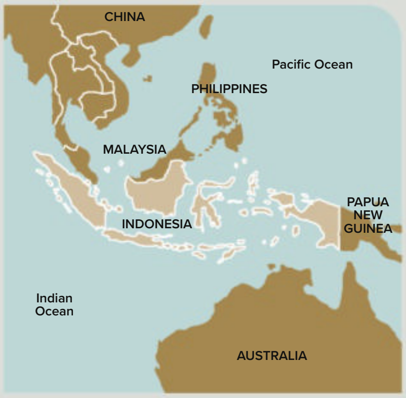
ABOUT THE AUTHOR

Daniel Allen is a London-based award-winning journalist and photographer with a focus on conservation. He has written for *The Guardian*, *The Sunday Times* and *National Geographic*.

ABOUT THE PHOTOGRAPHER

Garry Lotulung is a freelance photojournalist based in Java, Indonesia. He specialises in stories about environmental crises, the human condition and social change.

Where is Indonesia?



Indonesia is a country located off the mainland of South-East Asia that consists of more than 17,000 islands, including Java, Sumatra, Sulawesi and parts of Borneo and New Guinea

Five fascinating facts about the Javan slow loris

The rare primate possesses some remarkable abilities and adaptations

1 It's big and can see in the dark

The Javan slow loris is the largest of the Indonesian slow lorises. Adults typically weigh up to 1kg, and have an average bodylength of nearly 30cm. A layer of tissue located behind the retina of a slow loris eye reflects light that enters the pupil, enhancing the animal's nocturnal vision.

2 It feeds while upside-down

The primate is frequently seen hanging by its feet, so it can eat with both hands. It is an exudativore, feeding primarily on gums and saps from trees with its long, narrow tongue. It supplements this diet with nectar, insects and reptiles.

3 It produces venom

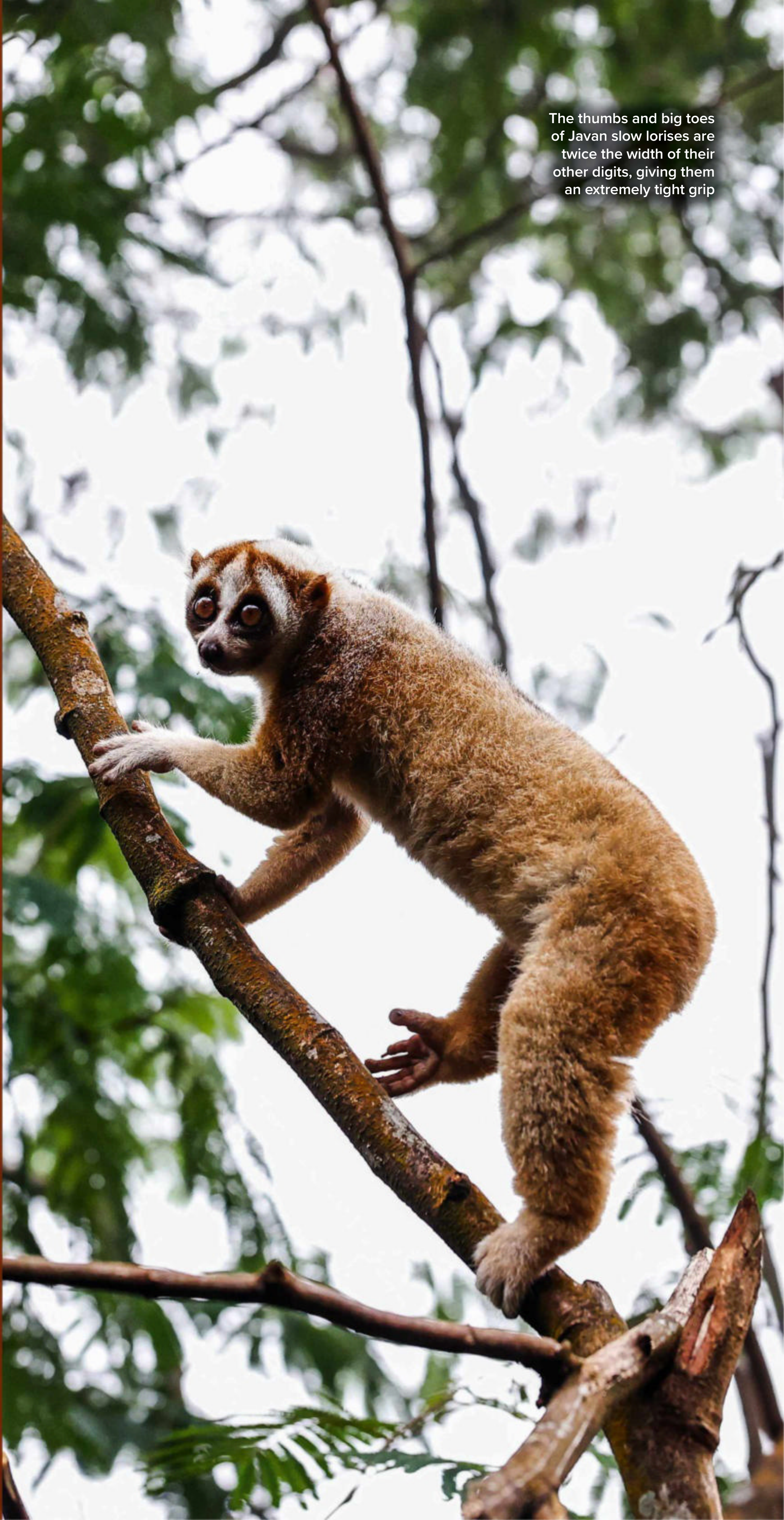
To produce its venom, the Javan slow loris licks oil-secreting glands on its upper arms. The venom from these glands then pools in the animal's canines, which are sharp enough to slice into bone. This highly toxic substance can cause death in small mammals, and anaphylactic shock and even death in humans.

4 It helps with pollination

The Javan slow loris transfers pollen between flowers when extracting nectar, and deposits seeds through its faeces. The primate further maintains the health of ecosystems as it is prey for snakes, raptors, felines and occasionally orangutans, and feeds on insects, reptiles, and sometimes birds and small mammals.

5 It sits still and silently in trees

The animal can grip tree branches and vegetation for hours, often remaining motionless to avoid detection. Its slow, silent lifestyle helps it to avoid predation, but it can pick up the pace if confronted with danger, and has thick neck skin as a last-ditch defence.



The thumbs and big toes of Javan slow lorises are twice the width of their other digits, giving them an extremely tight grip

IAR INDONESIA

Metal cases containing rescued Javan slow lorises are carried into the national park

“With human pressures, only 20 per cent of historic Javan slow loris habitat is now left intact”

venturing out at night to mostly feed on tree gums and saps. Like all slow lorises, it is an arboreal species, found in primary and secondary forests, bamboo and mangrove forests, and even commercial plantations. It uses vines and lianas to move from tree to tree, crawling across canopies, rather than swinging and leaping like other primates.

Unfortunately, the species is being forced into smaller and smaller pockets of increasingly fragmented forest. Java is home to some astonishing biodiversity, but also happens to be the most populous island in the world, with more than 130 million people living on a piece of land the size of England. With human pressures putting a significant strain on the island’s wild nature, only 20 per cent of historic Javan slow loris habitat is now left intact.

In April 2024, Indonesian photojournalist Garry Lotulung found himself in the rainforest of Mount Halimun Salak National Park, located around 100km south-west of the Indonesian capital Jakarta. He was following a procession of keepers carrying metal cases, as well as volunteers and veterinarians, strung out on the forested slopes ahead of him – many of them working for Indonesia’s Natural Resources Conservation Agency (BKSDA) and YIARI. Each metal case contained a Javan slow loris, ready to be returned to the park’s prime loris habitat.

While habitat loss is an ongoing challenge for those involved in Javan slow loris conservation, this challenge has been hugely compounded by the illegal wildlife trade. Most of the lorises being transported on the backs of the keepers had been rescued by the BKSDA.

“Over the past 10 to 15 years, a craze for keeping Javan slow lorises as pets has developed, driven by social media platforms such as YouTube, TikTok and Instagram,” explains Lotulung, who has worked to raise awareness of the issue since 2020. “Despite the fact that the Javan slow loris is strictly protected, many videos showing them being kept as pets have gone viral, driving up demand. Sometimes they’re kept as pets by Indonesian people, but they also end up overseas, in places such as Japan.”

“Habitat encroachment means Javan slow lorises are often found looking for food or shelter in plantations and bamboo forests, as well as in settlements,” adds Nur Purba Priambada. “Hunters simply pick them off trees, crate them up, and eventually they end up in markets. A hunter might get paid $10 or $20 for a loris, but by the time they’re purchased by the owner, they can cost ten times as much.”

When Javan slow lorises are confiscated, or abandoned by their owners, they often end up at YIARI’s Primate Rehabilitation Centre in the town of Ciapus, west of the city of Bogor. The largest rescue centre for slow lorises in Indonesia, it is also the only one in the country specialising in their rehabilitation and release. To date, the centre’s dedicated staff have saved more than 1,000 slow lorises, with more than 670 returned to the wild over the past 14 years.

The netting of an acclimatisation enclosure is checked

Preparing tree sap for hungry Javan slow lorises

Adorable looks have been the species' downfall

Rehabilitating a Javan slow loris that has been kept as a pet is far from straightforward. Belying its benign outward appearance, the species sports some bizarre evolutionary adaptations. Of these, the capacity to inflict a highly venomous bite, is perhaps the most complicating factor.

"Slow lorises are the only venomous primate, and one of only a handful of venomous mammals," explains Nur Purba Priambada. "They are remarkably territorial animals, and researchers believe they use their venom, which actually rots flesh, to settle disputes with other lorises. When they're caught, hunters and middle men frequently clip off or completely remove their teeth – using nail clippers, wire cutters or pliers – to make them easier to handle, and to prevent them biting other captive lorises."

This brutal practice frequently sees Javan slow lorises die from blood loss and infection before they're sold. It also means that many of the lorises that end up at the YIARI rehabilitation centre are sick and stressed. Their teeth are often infected and need to be extracted, which invariably condemns them to a life in captivity.

"On top of this, these animals are totally unsuited to being kept as pets in small cages," says Nur Purba Priambada. "Keeping them in bright conditions causes pain and suffering, their poor diet causes other problems, and they lose the ability to feed themselves.

"During rehabilitation, we give them the right food and enable them to re-learn their hunting skills. We give them care at night, which means we have to become nocturnal, too. We want to give all Javan slow lorises that could survive in the wild a second chance in nature, but they need to be healthy first."

For Garry Lotulung, the opportunity to document the return of a cohort of rehabilitated Javan slow lorises to the wild was too good to miss. The resulting hike into the tropical forests of Mount Halimun Salak National Park provided a rigorous test of both his photographic and physical skills.

"It was a two-hour trek to the release area base camp, and the keepers walked very fast," he recalls with a smile. "I often had to run ahead, uphill, to get the shots I wanted. Once the pre-release acclimatisation enclosures were set up, I focused on capturing the nocturnal feeding. I fell over many times on slippery paths in the darkness, but it was absolutely worth it. It's very rare to be able to photograph the Javan slow loris at night."

In partnership with Indonesia's Ministry of Environment and Forestry, YIARI carries out habitat surveys to identify the best sites to release rehabilitated lorises. There needs to be enough food and trees, community support and protection, as well as other slow lorises living wild in the area. After three to five days spent in acclimatisation enclosures – during which time they're fed, monitored, and fitted with radio collars – the animals are set free.

"We keep track of the released lorises for several months," says Nur Purba Priambada. "Their survival rate is usually no more than 40 per cent, but it's the best we can do."

Released individuals are fitted with GPS collars and tracked for several months

Lotulung is cautiously optimistic about the future of the slow loris. "It's heartbreaking to see the condition of these lorises when they come to the rehabilitation centre, which is why I will keep raising awareness of the illegal pet trade issue. But having seen the work of the YIARI team and their partners first-hand, I really believe they can be saved from extinction."

Under its partnership with the Indonesian government, YIARI's work to conserve the Javan slow loris goes beyond returning animals to health and to the wild when they can. The NGO is also involved in wide-ranging efforts to raise awareness and promote coexistence – organising educational and community engagement initiatives, social media campaigns and research programmes. They also support the government's law enforcement efforts.

"We want as many people as possible to understand that the trade in these animals for pets is cruel, illegal and hugely destructive," says Nur Purba Priambada.

According to data from YIARI, at least 5,500 Javan slow lorises have been observed in physical and online markets since 2012. This activity peaked in 2017, when more than 900 were traded.

"We still lack accurate information about population numbers, but over the past few years we've seen fewer and fewer Javan slow lorises with clipped teeth, and we're seeing fewer and fewer animals arrive at the rehabilitation centre," says Nur Purba Priambada. "I like to think this is because our collaborative efforts at combatting the illegal trade in these animals are proving effective. I hope the trend will continue – not only because this is an amazing animal in its own right, but because slow lorises are a vital part of Indonesian wild nature."

"Belying its benign appearance, the species has the capacity to inflict a highly venomous bite"

IAR INDONESIA

Signs bearing the names of the lorises help keepers to identify them in their cages

Listen to *Ramblings: Big Cats! Rick Minter in Gloucestershire*

Big cats in BRITAIN

Sightings and DNA tests suggest that large cats such as black leopards are quietly naturalising in Britain. Here's the whole story.

By **RICK MINTER** *Illustration by* **DANIEL LONG**

"It was rolling on the compost heap, where I rake up deer droppings," said a groundsman, describing the giant black cat he confronted in the grounds of a care home in south-west England, back in 2012. "It jumped the fence and went like a rocket across the next field."

A month later, the remains of a half-eaten roe deer appeared overnight, behind a hedge but closer to the property. It showed the predator's canine impacts, sunk into the windpipe area, 4cm apart. For the next few weeks, staff on the night shift parked as close as they could to the entrance door. No one gossiped about their secret feline visitor. I was asked informally for advice, and also knew to keep it quiet.

Something lurks in the shadows of our rural idyll. Similar incidents play out in farms, stables, rural estates, golf courses, utility holdings, landfill sites and even nature reserves across the country. Large cats, mainly resembling black leopards (also known as panthers), but also sometimes mountain lions, and, very occasionally, lynx, are reported across such locations.

Of the 40 species of wild cat, these three are consistently described, year on year. But witnesses usually keep their heads down, keen to avoid a commotion or perhaps fearful of social ridicule. After all, if you claim to have seen a big cat in Britain, few people are likely to believe you.

On five occasions now, perfect footage of encounters has been shown or described to me in detail, captured on phone cameras, trail cameras and CCTV. Yet not even offers of cash would persuade these informants to part with their evidence. Privacy, shooting rights and business status are simply too much to lose.

I became immersed in the possibility of big cats being present in Britain 24 years ago, after seeing what I'm convinced was a black leopard in Cumbria. It was walking side-on to me across rough pasture, about 70m away. I assumed it was a labrador, but then noticed no collar and no owners in sight. Its purposeful strides, low and long-bodied form, tubular tail and fluid movement were completely unlike a dog.

Since then, I've spoken to some 1,500 fellow witnesses. I meet them at my talks, at an information stand I take to rural shows, and through my podcast, *Big Cat Conversations*. After appearing on BBC Radio 4's *Ramblings* with Clare Balding – who has also seen what she thinks was a British black leopard – I received 40 emails from listeners, keen to describe their own encounters. People offload their big cat story when they find the right context.

On the podcast, I hear people's conviction, with full-on testimonies of big cats perfectly at ease in the British landscape. They are seen racing into flocks of geese, warming themselves in the morning sun and fleeing out of barns when disturbed. Mothers are even seen guiding cubs.

The suspected sightings are far and wide across the country. In Essex, a fisherman was hissed at by a black leopard (he noticed its rosettes) at 5am as he disturbed it cornering a muntjac deer. In Somerset, a dog walker watched a black leopard take down a roe deer in the adjacent field – she located the dragged and neatly eaten carcass three days later, when she felt safe to return. In Dorset, a woman watched a black leopard effortlessly descend a tree after targeting a squirrel's drey 12m up.

> "Witnesses usually keep their heads down, keen to avoid a commotion or perhaps fearful of social ridicule"

> “With a ready menu and a moderate climate, Britain offers big cats a stress-free situation”

Snippets of footage from the last two events are on the *Big Cat Conversations* website, but otherwise footage is rare, or just a pixelated blur. Many people assume at first that the animal is a dog, so don’t reach for their phone. Some are too wary to film a close-up predator; others have to focus on controlling and leashing their dog. Around 30 per cent of cases involve witnesses with a dog or horse. Often, the animal is the first to react, becoming spooked or nervous, and alerting its owner.

THE REPORTS ARE CONSISTENT in all regions. Year on year, around 80 per cent of animals sighted resemble black leopards – sleek, with extra-long tails (a mating pair of black or melanistic leopards will produce all-black litters). There are no reports of shorter-tailed, more thick-set cats, so black jaguars don’t fit the bill. Tan-coloured cats are also seen in around 15 per cent of cases, matching the description of a mountain lion (also known as a puma or cougar), and around 5 per cent fit the description of the Eurasian lynx, our former native larger cat.

Witnesses mostly describe fit, muscular, confident cats. In rare instances, depigmentation in a black leopard is described, such as a white blaze or the ‘cobweb’ morph, but otherwise, the animals show no struggle with inbreeding.

So how did these cats spill into our landscapes? Quite simply, they were put here. They are likely the result of dumped pets and guard animals, released collections, discarded military mascots, illegally traded wildlife, and leakage from run-down, homespun zoos. While various big cats have always been collected, the mystique of the black leopard has an enduring appeal, making it a particularly popular choice to keep in captivity.

A first wave of releases may have occurred during wartime. Cats are strict carnivores, so meat supply would be a challenge during times of rationing. Over several decades, there may have been further release events at different times and places, all helping the gene flow.

Leopards, pumas and lynx occupy a similar niche. They like edge habitat, woodland and scrub – they play an ecosystem role as deer killers and can sweep up smaller prey such as rabbits, hares and pigeons. They are generalists, highly adaptable and extremely stealthy, staying out of sight and avoiding humans. They occupy a range of environments, temperatures and altitudes in their native lands. With a ready menu and a moderate climate, Britain offers a stress-free situation. Our winters are much gentler than the harsh temperatures and deep snow that mountain lions experience in North America, for example.

One of my podcast guests was a precision engineer by trade. He had a brush with a big black cat one evening, when his dog disturbed it eating a rabbit. Like many informants, he admired and respected the cat after reflecting on the scary situation. “Black leopards are precision engineered for a British wood,” he said.

The idea that big cats are living in the UK might seem far-fetched, even romantic. It’s perfectly natural to react with scepticism. Though any serious investigator will carefully scrutinise each report, analysis is currently uneven, and I am advocating for a consistent classification system to be used by all investigators. The system that currently exists, and that I use, ranks sightings from A+ (‘Definitive Close Encounter’) to E (‘Uncertain’), taking into account factors such as scale, behaviour and form. Only two per cent of British big cat encounters fall into the A+ category.

WE MUST ALSO LOOK AT the scientific evidence. Positive DNA results proving the presence of big cats in Britain are limited, yet do exist. There are six publicly known positive DNA results that match the leopard (*Panthera pardus*), two from recent years: from Gloucestershire in 2022, from a hair snagged on a barbed-wire fence in the vicinity of a sheep kill; and from Cumbria in 2023, when DNA was found on a carcass – again, of a sheep.

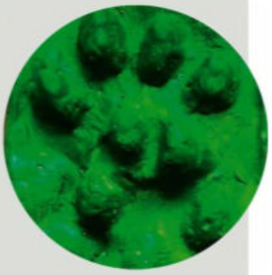
The lab that tested the 2022 sample wished to remain anonymous; the second was tested by professor Robin Allaby of the University of Warwick, who set up a testing service 12 years ago. He has tested numerous samples since, with limited success (perhaps partly due to the challenges of swabbing for big-cat saliva, which degrades quickly). His testing has been facilitated by the claw of a shot-and-stuffed black leopard, which provided a DNA sequence for cross reference. The few previous positive leopard sample sequences, verified elsewhere, have also been banked with him.

SCIENCE & SIGNS

The evidence

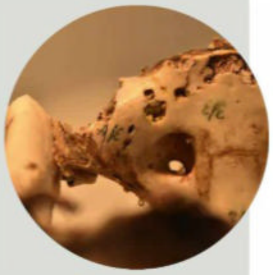
Footprints

Plaster cast of footprints showing the back foot stepping into the front foot position, taken in Dorset in 2021 by naturalist Jonathan McGowan



Tooth pits

Pelvis from a sika deer carcass found in Dorset. The scale and spacing of the toothmarks here is indicative of a leopard or puma-sized cat.



DNA

A sheep carcass that yielded a positive DNA result for the *Panthera* genus, also exhibited tooth pits that were in the range expected from a big cat species

DNA can tell us more than leopards simply being present in the UK; it could indicate their provenance. Are these cats just an assortment of vagrants, or are they from a common source? Is there now a British strain of them? But getting to this point will be a challenge. "We need to establish multiple samples at genomic or subgenomic level that show relatedness between individuals, and that point to a living population," says Allaby.

Toothmarks on bones are another way to scientifically verify if the assailant was a big cat. The technique, known as 'tooth pit analysis', is carried out at the Royal Agricultural University in Cirencester, and concentrates on small notch-marks or 'pits', made by the cusps of teeth. These can indent the bones of prey species when a predator is at work.

"By measuring the length, breadth and spacing of the pits we can make judgements on the predators involved," explains associate professor Andrew Hemmings. "Of particular interest to us are the indentations from molars and pre-molars. These distinguish marks left by large carnivores such as domestic dogs from those created by big cats."

In recent years, scores of bones, mainly from deer, have been provided to Hemmings, many bearing tooth pits. To date, four samples fall into the range expected for imprints from a leopard or puma-sized cat.

AS WELL AS SCIENCE, WE CAN look to other forms of evidence, such as tracks and signs. Mark Graves, now based in Britain after 18 years as an elite wildlife guide in South Africa, is confident about the evidence shown to him. "I've seen several prints and casts that match large cats, like the leopard, from different parts of Britain. A trail camera recently recorded a leopard in Devon 'sawing' [making a raspy call to establish a territory or find a mate]," he says. "Some of the carcasses are compelling, too – freshly filleted deer remains compare well to how leopards leave impala prey in South Africa."

Graves is frustrated that more systematic searching isn't happening. "Too often it's just a single sign, like a footprint, that's found, when there must be more clues. But the logistics of tracking are difficult – trails may go onto private land, for example. With more dedicated funds, trust from landowners, and techniques like employing scat-detection dogs, I've no doubt we'd make more progress," he says.

We know the black leopard as Bagheera from *The Jungle Book*. Their main natural refuges are the Malay Peninsula, where people call them panthers, and to some extent, Java. Their numbers are in serious decline due to various pressures, including poaching. Are these Asian leopard locations the main source of what people experience in the woods and valleys of Britain?

Whether you are a believer or a sceptic, the topic of big cats in Britain is steadily growing in interest, and there are more snippets of hard evidence. British universities are supporting studies, and some wildlife specialists are cautiously helping investigation efforts. With concerted effort, maybe more discoveries await.

ABOUT THE AUTHOR

Rick Minter is author of *Big Cats: Facing Britain's Wild Predators* and hosts the *Big Cat Conversations* podcast

One of the largest birds of prey in North America, the bald eagle has an impressive 2m wingspan and can soar for hours on thermal currents

REACH FOR THE SKY

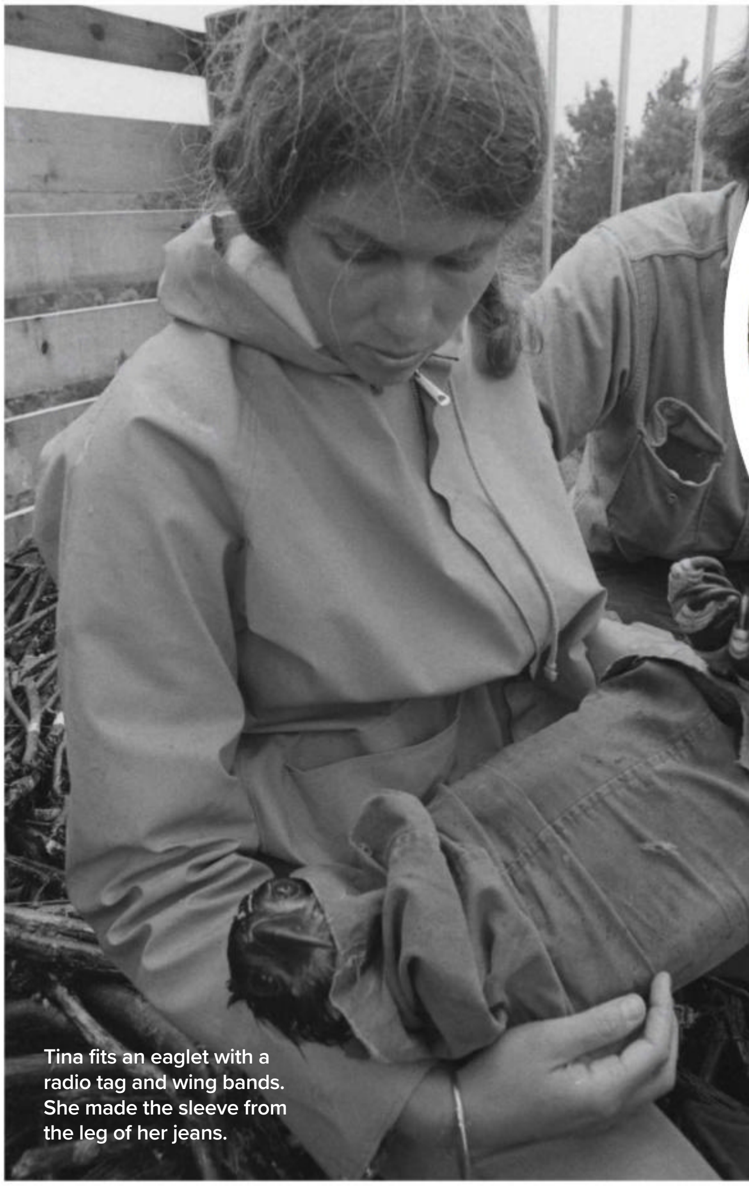
In the 1970s, the bald eagle was on the verge of extinction. Thanks in part to the pioneering work of one young biologist, this magnificent bird has made a spectacular comeback.

Words by **MELISSA HOBSON**

BALD EAGLE: ALAN MURPHY/NATUREPL.COM

Bald eagles have superb vision, able to spot prey from a distance of 3km

SAILING THROUGH THE AIR WITH ITS COLOSSAL, 2m wings outstretched, white head and yellow beak contrasting with its dark body, there’s no mistaking one of North America’s most iconic birds: the bald eagle.



Tina fits an eaglet with a radio tag and wing bands. She made the sleeve from the leg of her jeans.

Eyries, in tall trees near water, can be re-used year after year

The USA's national bird has had a rollercoaster ride. Many people are familiar with the species' astounding recovery following a brush with extinction, but one chapter in this incredible success story usually flies under the radar: a young woman alone in the woods, hand-feeding a vulnerable pair of eagle chicks.

Before she had landed this unusual role as eagle foster-mother, Tina Morris, a graduate from Cornell University, knew little about these birds. "I have to admit," she recalls, "there were many times when I thought 'what on Earth am I doing here? How exactly am I going to manage this?'".

Her work was a vital intervention. Once abundant across the USA, the bald eagle was nearly eradicated by the mid-1900s as a result of hunting, habitat destruction and, most significantly, the pesticide DDT, a cheap and effective chemical that had been widely used in agriculture and as a malaria control since the 1940s.

DDT was a disaster for bald eagles. It was banned in 1972, but the damage had already been done. The chemical lingers in the environment for many years, becoming increasingly concentrated as it travels up the food-chain. It washed into rivers and was absorbed by fish, which were then eaten by the eagles and other birds of prey. The contamination had catastrophic consequences for the birds' reproduction. When a female laid her eggs, the chemical caused the shells to become so weak that they couldn't withstand their parents' weight, becoming crushed during incubation.

This majestic bird had been adopted as the national emblem of the USA back in 1782, partly as a symbol of strength and also because the species is endemic to North America. At this point, there may have been around 100,000 bald eagles in the wild. By 1963, numbers had reached a record low, with just 417 nesting pairs remaining. "It really showed what incredible damage that pesticide caused," says Tina.

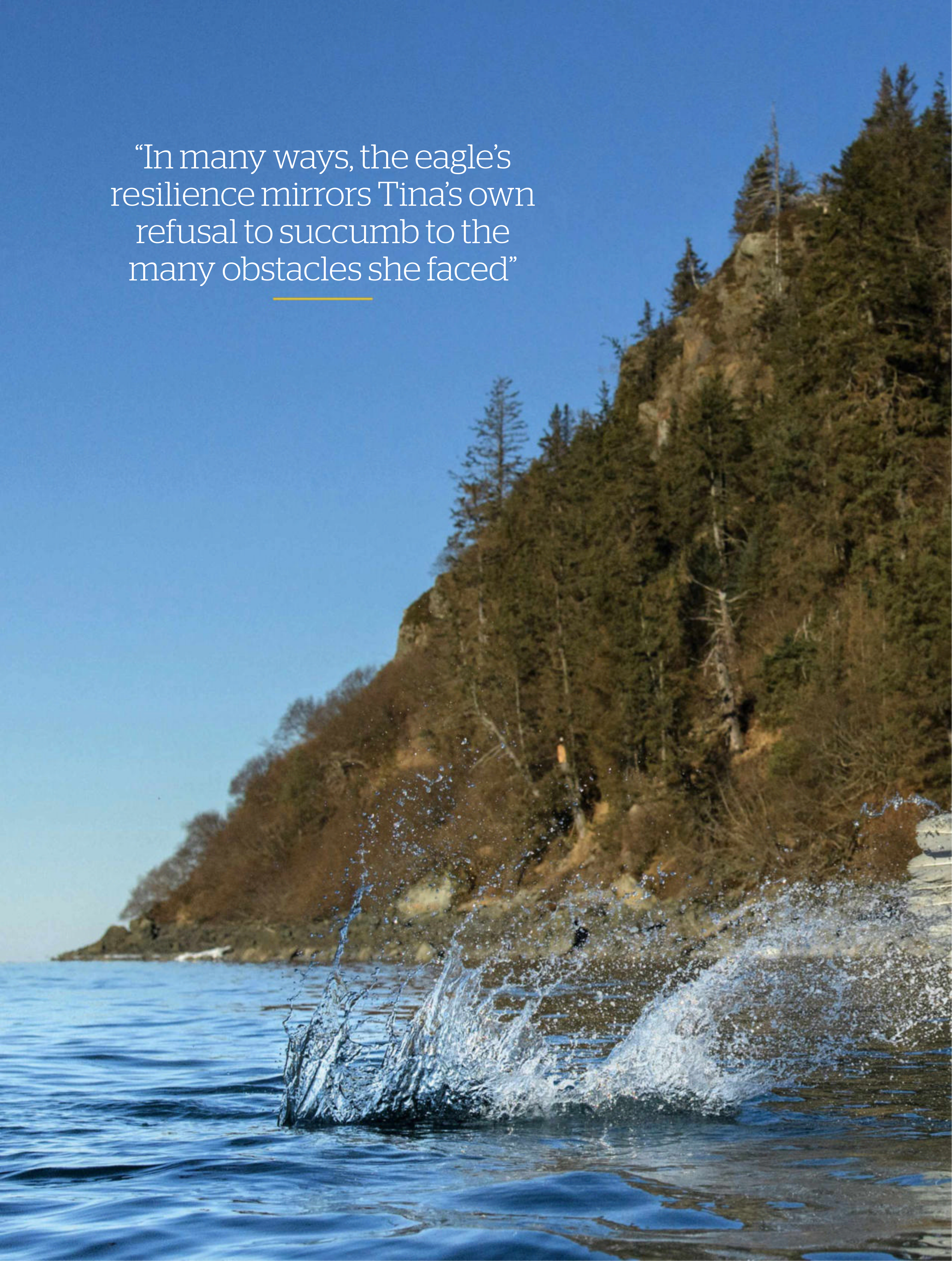
TO HELP BRING THE SPECIES back from the brink, Tina was tasked with devising a 'hacking' programme (raising birds without parents) that would become a blueprint for others to follow. The project was a key part of a wider effort to repopulate the species across eastern North America, and followed in the wake of a hacking programme for captive-bred peregrine falcons, developed by ornithologist Tom Cade. Tina had been desperate to work with the peregrines, but the project was fully staffed. So, when the bald eagle programme launched, timed to coincide with the United States' bicentennial celebrations on 4th July 1976, she leapt at the chance to take on its daily operations. She spent the next two years rearing a total of seven eaglets in Montezuma National Wildlife Refuge, New York, before handing over to the Department of Environmental Conservation in 1978.

Unlike the peregrines, nobody was captive-breeding bald eagles in the 1970s. The starting point, therefore, was to take 'spare' chicks – bald eagles lay up to three

ABOUT THE AUTHOR

Melissa Hobson is a marine science and conservation writer based in Hastings. She's written for *National Geographic*, *Scientific American*, *The Guardian*, *The Sunday Times* and more.

TRIO OF BALD EAGLES: BARRY BLAND/NATUREPL.COM; TINA TAGGING EAGLE: CORNELL UNIVERSITY; EAGLE'S NEST: JIM BRANDENBURG/NATUREPL.COM



> "In many ways, the eagle's resilience mirrors Tina's own refusal to succumb to the many obstacles she faced"

BALD EAGLE OVER WATER: ALAN MURPHY/NATUREPL.COM

Bald eagles are attentive parents, with both male and female bringing food to their chicks

> “Tina would climb the tower to feed her ‘babies’. She hadn’t told anyone she was terrified of heights.”

eggs, but usually only successfully feed and raise two hatchlings – from populations in the Great Lakes states that had managed to evade the effects of DDT. These eaglets would be transferred to New York State to be raised by a human mother until they were ready to fly off on their own. That’s where Tina came in. “It was a huge responsibility,” she says, “but a tremendous honour.”

BALD EAGLES NEST IN MATURE conifers and tall hardwoods, whose solid branches can support the weight of their massive dwellings. To replicate this, Tina and other researchers built a 1.5m eyrie using branches and sticks, designing it to resemble a natural nest as closely as possible, and placed it at the top of a tower made of telegraph poles. Two nine-week-old eaglets, who arrived by plane on 18th June, were the first to be installed. Tina recalls how, with beaks clacking and wings flailing, the youngsters “leapt onto the nest and stood like statues”.

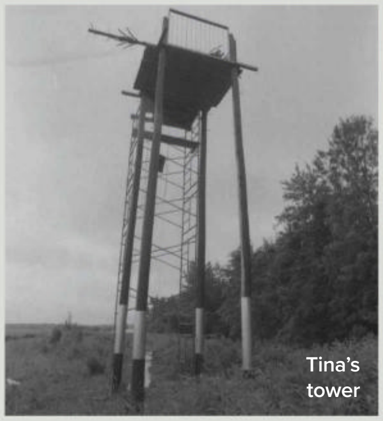
And so began Tina’s new normal. Her accommodation was a tent at the foot of the tower (which flooded on her first night); her bathroom a latrine she dug herself. Other than the young eaglets above, her two dogs were her only companions.

Every day, Tina would rise at dawn and climb the tower to feed and care for her ‘babies’. She hadn’t told anyone that she was terrified of heights. With no manual to follow, she started by rigging up a long stick with a barbecue fork taped to the end, offering the birds carp she had fished herself from the spillway of a nearby dam. So that the eaglets wouldn’t associate humans with food, she had to conceal herself in a tiny hide, sitting cross-legged for hours at a time.

In the wild, bald eagles teach their young everything they need to know before fledging, such as how to swoop down and grab a fish from the river, and how to tear into its flesh with their curved beaks. “Parents normally break the prey open and let their chicks pull the meat out,” says Tina. “But these youngsters had to figure out how to break into a big, scaly fish on their own. They had to try everything out for the first time.”

During those early weeks, Tina spent hours noting down everything the eaglets

Nesting instinct


Tina’s tower

The location of the nesting tower was key to the success of raising the eaglets without parents. The young birds had to be kept out of the public eye until they had fledged, so needed to be reared within a protected area. They required tall trees for potential future nest-sites (adults often return to their natal area to breed) and ample water bodies for hunting fish. Montezuma National Wildlife Refuge, a 4,000ha expanse of swamp, marsh and streams, was perfect. Managed for migratory waterfowl, it offered a mosaic of pools and trees and was just 60km from Cornell University, allowing the researchers easy access. It was also a historic bald eagle breeding site, having hosted nesting birds until the late 1950s.

Tina today, with dog Maddie

Tina was the first female honorary Iroquois

Honorary Iroquois

The bald eagle is revered by the Iroquois and other Native American peoples as a sacred part of their heritage. Thanks to her work to protect the species, Tina was formally inducted as an honorary Iroquois into the Confederacy of Six Nations. She was the first female honorary Iroquois, which meant that, for the first time, the chiefs' wives were able to join in the celebrations.

did – feeding, preening, squabbling, flapping their wings. In time, she fitted the youngsters with radio-collars so that, when they fledged, she could track their movements and locate them when they inevitably fell and needed assistance. She learned everything there was to learn about how these birds grow and develop. "They're like teenagers," she recalls. "You find yourself sort of chuckling at some of the crazy things they do."

Despite the bond she felt as their sole caretaker, Tina didn't find it hard to remain aloof from her young charges. "Eagles are wild," she says. "I know they could hurt me – if I tried to hug them, I would not be very happy, and neither would they." Above all, she wanted to see the birds flying free.

ADULT EAGLES MIGHT SOAR majestically through the air, but their first forays into flight are rather less elegant. A fledgling is clumsy and doesn't know how to land on tree branches, often descending to the ground like an "out-of-control helicopter". While Tina's eaglets were adapting to life in the air, she was on hand to rescue them after any mishaps. "If an eagle fell from the tower when practising for take-off," she says, "I had to capture and restrain it, and carry it back up the ladder to the nest without being torn apart."

Eventually, the young birds started to venture further from home, and Tina was filled with pride when, through her binoculars, she witnessed one of them make its first kill. She had succeeded in raising her charges to independence; before long, they would leave the tower for good and, hopefully, raise families of their own.

In September 1976, another young eagle came into Tina's care, but was found dead, caught on a barbed-wire fence. Four more arrived in June 1977 and the process started again, this time with a bigger nest and researchers shadowing Tina in order to continue her work. A month later, a fifth bird, found in Minnesota with a broken leg, joined the foursome following its rehabilitation. This individual would go on to live for 38 years – the oldest bald eagle ever known – and produce an incredible 70 young.

Bald eagles can reach as much as 6.5kg in weight with a wingspan of up to two and a half metres, with females usually slightly larger than males. Their piercing yellow eyes can spot prey from 3km, and they can plummet at a breakneck speed of around 160kph to grab fish from the water with their piercing talons. The sight of these powerful birds can take your breath away, and despite having worked with them so closely, that's still the case for Tina. "I'm used to seeing them and I've seen many," she says. "But they still have that effect on me."

The original aim of the hacking project was to boost numbers of breeding pairs in New York State, with the hope that the birds might disperse into neighbouring New England, "so we could also boost the population there from practically nothing to something," says Tina. She could never have imagined just how effective the programme would be. By 2023, there were 426 breeding eagle pairs in New York and 917 in New England.

Thanks to its success, and that of other repopulation projects, plus the ban on DDT, the bald eagle had recovered enough to be delisted from the USA's Endangered Species Act in 2007. Today, it can be found in every US state except Hawaii, and is designated as Least Concern on the IUCN Red List.

In many ways, the eagle's resilience mirrors Tina's own refusal to succumb to the many obstacles she faced. As a young woman in a male-dominated field, she had no female role-models to turn to for advice and inspiration. But she didn't let the challenges distract her from her main goal: keeping her chicks alive. "The entire nation is going to know if they die," she would tell herself, "And it will be on your watch."

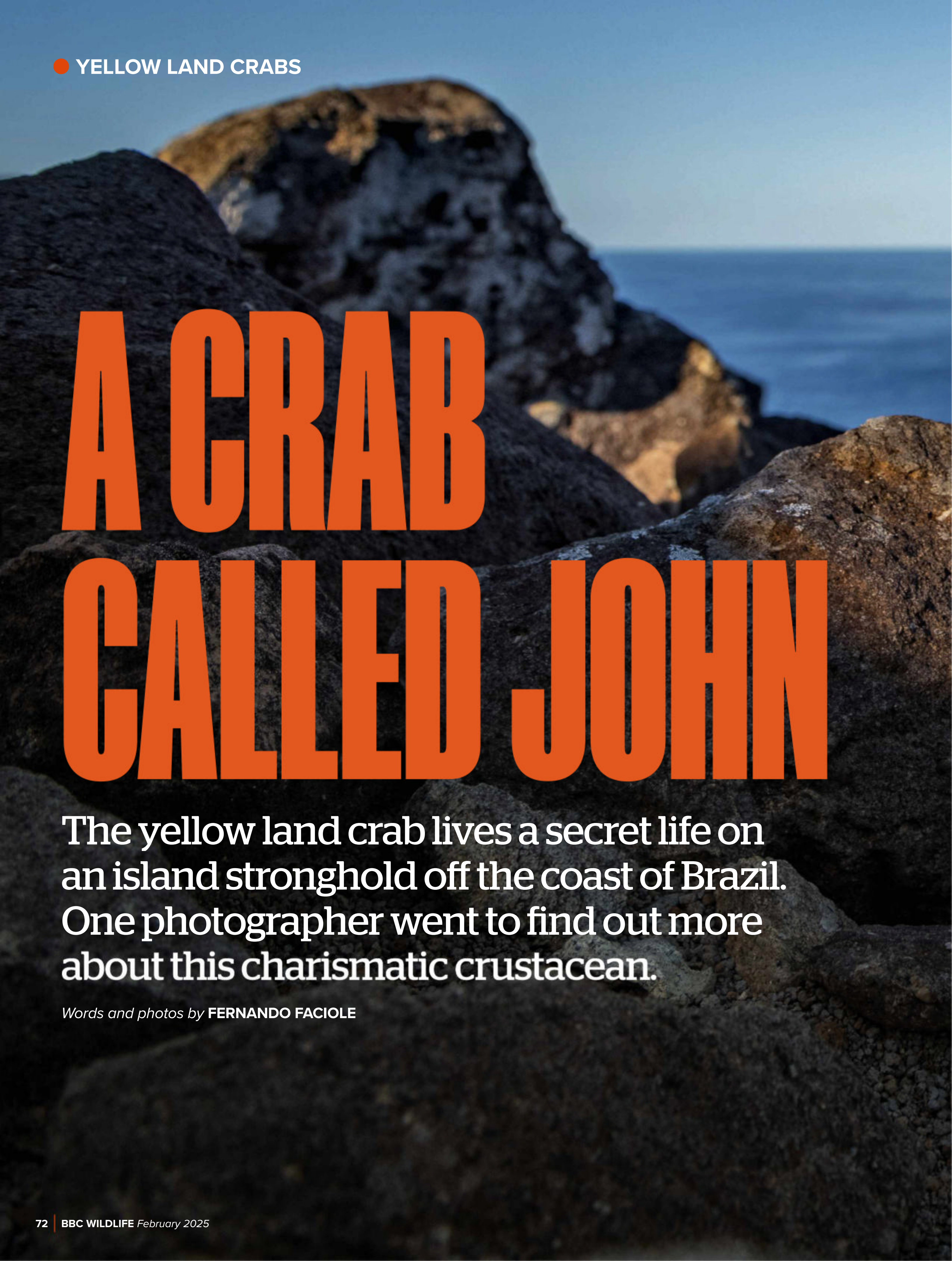
She took things one day, one moment, at a time. "I've got to make sure they have enough food. I've got to protect them, and I basically have to do what their parents would do," she recalls. "If I do that, we'll be okay."

THOUGH BALD EAGLES ARE flying once again in America's skies, challenges remain. Poaching, avian flu, vehicle collisions, poisoning from lead shot used by hunters and chemical pollution all pose risks, and windfarms near nests can harm juveniles. "Young birds are very clumsy," Tina says. "If they flew towards a windfarm, they wouldn't be able to avoid those huge paddles."

As someone who has always tried to avoid the limelight, Tina has, over the years, learned the power of telling the story of bald eagles. "Birds can't speak," she says, "and the only way we can save them – and all wildlife – is to speak for them".

Tina Morris' book, *Return to the Sky* (Chelsea Green, £22) is available now.

TOWER AND IROQUOIS CEREMONY: CORNELL UNIVERSITY; TINA AND MADDIE: LARRY MORRIS; EAGLE AND CHICK: MARK NEWMAN/GETTY



A CRAB CALLED JOHN

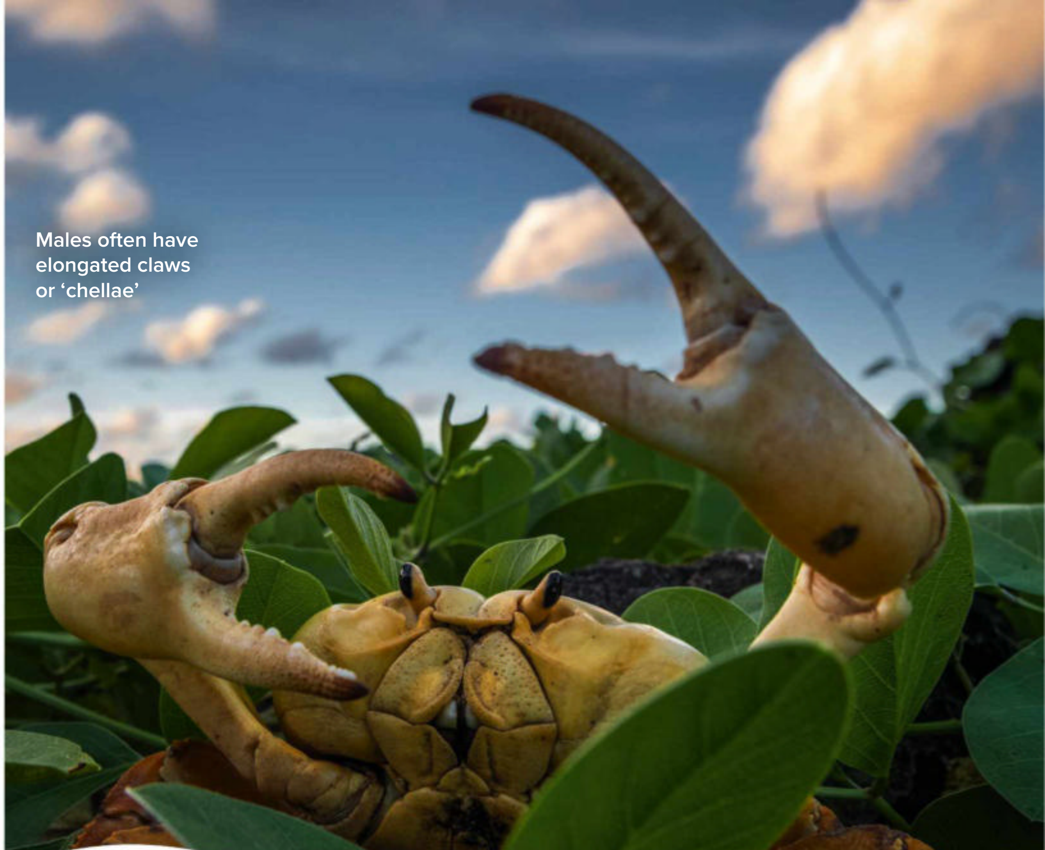
The yellow land crab lives a secret life on an island stronghold off the coast of Brazil. One photographer went to find out more about this charismatic crustacean.

Words and photos by **FERNANDO FACIOLE**

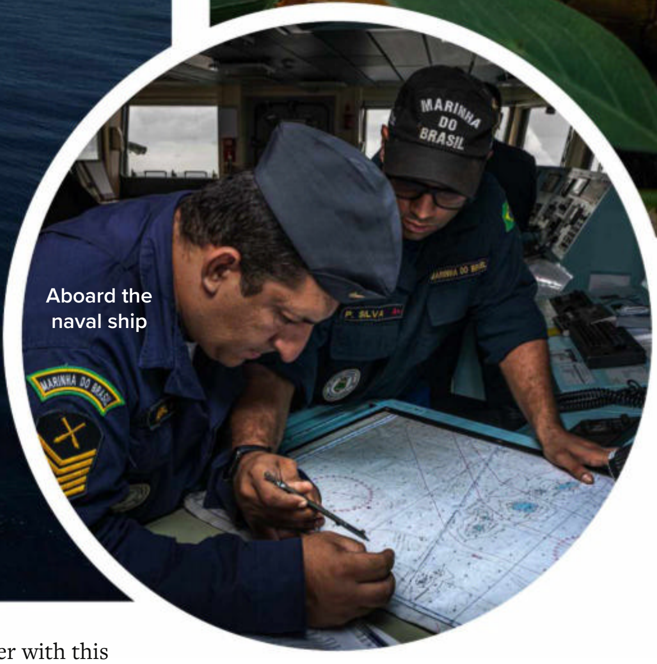
Globally, the yellow land crab can only be found on three other islands

The volcanic island of Trindade was thrown out of the sea three million years ago

I’M CROUCHING UNCOMFORTABLY AMONG SHARP volcanic rocks, yet I’m buzzing with the thrill of discovery. Behind me, a vast sea stretches to the horizon, the waves crashing against the shore with a rhythmic roar; in front of me, a large, vivid crustacean is scuttling across a dark, lumpy outcrop with a gentle tip-tap of its claws, offering a welcome burst of colour in this rugged, almost alien landscape. It’s a yellow land crab, otherwise known as John.



Males often have elongated claws or ‘chellae’



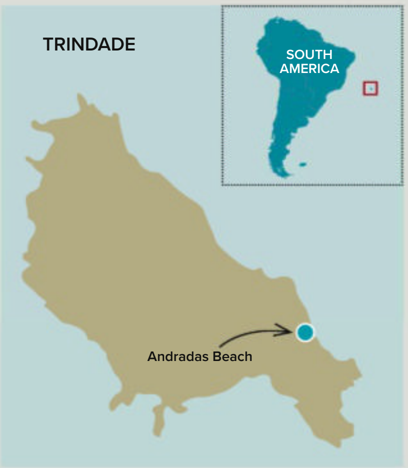
Aboard the naval ship

This is my first encounter with this species, yet it feels like I’m greeting an old friend. Ever since I first clapped eyes on an image of a yellow land crab, I’ve been eager to find it and tell its story. Seeing it in the flesh is a dream come true.

It’s March 2024 and I have just arrived on the remote island of Trindade, about 1,100km east of the coast of Brazil, on a four-day photographic assignment. With me is Márcio João, a doctoral student from São Paulo State University. We are lucky to even be here: Trindade is off-limits to the general public, and the only way we could get to the island was by hitching a lift with the Brazilian Navy, which supports research through the ProTrindade project. Our ocean odyssey from Rio de Janeiro had been marked with endless views of blue, engaging conversations and games of dominoes.

With the Navy shielding its shores and no human presence save a small military base and a research station, Trindade is a sanctuary for wildlife. This protected island, stretching more than 10km², allows the Johns – and other wild residents – to live out their lives in peace. Its jagged profile, characterised by rugged peaks as much as 620m high, points to its volcanic history. The sheer cliffs teem with seabirds such as boobies and petrels, and the endemic Trindade petrel, while the surrounding waters are home to myriad species of sharks and cetaceans, including humpback whales, which arrive during the winter months.

Where is Trindade?



Trindade is the largest island in the Trindade and Martim Vaz archipelago, which comprises five islands in total and lies about 1,100km off the coast of Brazil. It’s the country’s easternmost point.

ABOUT THE AUTHOR

Fernando Faciole is a conservation photographer based in Brazil who focuses on Latin America, shedding light on endangered species and threatened ecosystems

The Johns tend to be more active when the sun sets

A close-up view of the crab's eyes and mouthparts

Green turtles use the same beaches to lay eggs

The yellow land crab *Johngarthia lagostoma* is named after John Garth, a distinguished American naturalist. It's a relatively hefty species – on Trindade, its carapace can reach up to 10.7cm, and the powerful claws can grow as large as 10.5cm.

While the species occurs on three other islands – Fernando de Noronha and Rocas Atoll, both part of Brazil, and Ascension Island – Trindade is its last stronghold. It is not listed as Endangered on the IUCN's Red List, yet is considered so by Brazilian researchers, who are currently trying to determine the exact size of the population. On Fernando de Noronha and Ascension Island, the Johns have faced significant threats from humans, including harvesting for food.

Indeed, there is still lots to learn about the life of the Johns: the first research expedition to Trindade only took place in spring 2019. Since then, the study team has undertaken five more expeditions, totalling seven months on the island. They've managed to collect data, such as sex and body measurements, on 1,500 individuals.

Researchers Márcio João (*left*) and Esli Mosna on night duty

“Each female releases about 80,000 eggs during full-moon tides”

The Johns are terrestrial creatures and live scattered across the island. They are largely nocturnal and solitary by nature, coming together only in the mating season and going their separate ways immediately after copulation. Yet they undertake a migration en-masse during the breeding season, a spectacle Márcio and I had timed our visit to witness.

Adults live in the vegetated, humid and cooler mountain areas, but migrate down to the beaches for reproduction. The mating season and all associated reproductive processes occur from November to May, across all four of the species' oceanic island homes. Once they've mated, female crabs store the sperm in a seminal receptacle and retreat to their burrows where they wait for their eggs to mature. The eggs are then fertilised internally and transferred to the abdomen. When the eggs are ready to hatch, the females emerge and make their way to the sea, each releasing about 80,000 eggs during full-moon tides.

The eggs hatch upon contact with seawater, developing into larvae known as zoeas that resemble tiny shrimps. The zoeas swim near the surface, feeding on smaller plankton. After another three to four weeks, they move into the next stage of development, megalopae, at which point they resemble tiny adult crabs. They then move towards the land, guided by chemical signals, coming ashore during the next full-moon high tide.

Leaving the water behind, they must now navigate rocks and sand to seek shelter from predators, sometimes travelling almost

The crustaceans spend time on the island's highest hills and mountains

> “Their huge claws gently move above their heads as if giving me a welcoming wave”

a kilometre inland. They typically hide away under rocks until they've completed their final moult to become fully fledged juvenile crabs. Once their shells reach about 1cm in width, they emerge from their hideouts and begin their journey into the mountains.

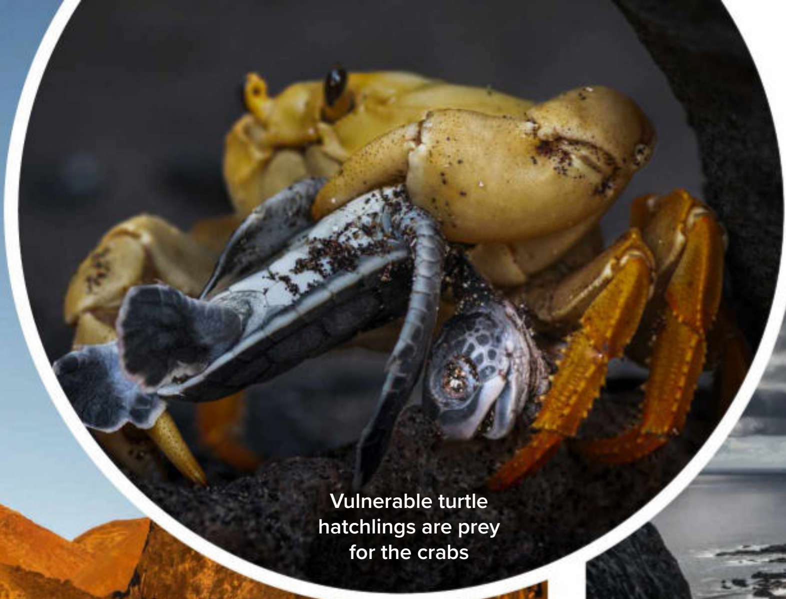
I need to get to my accommodation in the research station and unpack, yet I am transfixed by the John in front of me, and several others I have spotted nearby. Unlike many crabs, including their agile cousin, the Sally lightfoot crab, Johns move very slowly. Their large eyes seem to be studying me intently, and their huge claws lend them an almost robotic appearance, gently moving above their heads as if giving me a welcoming wave. It is with great reluctance that I eventually drag myself off to my digs.

I unpack quickly, then join Márcio and Master's student Esli Mosna for an evening of survey work on Andradas Beach. The sun is setting, and the large swathes of vegetation near the beach are rapidly transforming into crab gardens. Hundreds of Johns are beginning to emerge from their burrows higher up the slope, clustering among the vegetation, spreading out and gathering around my feet with a noisy clacking of claws. Their movements are slow and deliberate, yet there are so many of them that the ground is swirling.

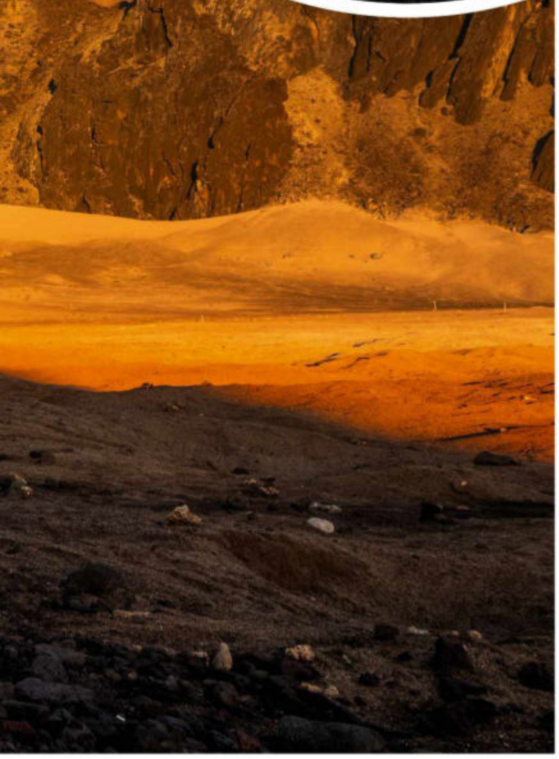
Suddenly, I am more preoccupied with not treading on the crabs than I am about taking good photos of them. I now understood what Márcio meant when he said that these animals truly dominate Trindade.

I capture some images of the Johns and of the researchers setting up transects, and we wait for darkness to fall, so we can observe the crabs' night-time activity. One aim of the research is to understand the genetic connectivity among the individuals distributed across the four islands.

Marcelo Pinheiro, coordinator of the Research Group in Crustacean Biology at São Paulo State University, explains that what first struck him about the Johns was their curiosity. “They approached me without hesitation. It was unforgettable, something that only a preserved environment like Trindade can offer,” he recalls. “My scientific



Vulnerable turtle hatchlings are prey for the crabs



Trindade's vegetation is slowly returning

Green again

Trindade wasn't always the rugged island it appears today. Its appearance changed drastically once it started to be frequented by humans, particularly following the introduction of goats in 1700. With no natural predators, the goats grew rapidly in number and consumed nearly all of the island's plant cover. The goats were finally eradicated in 2005, allowing Trindade's native vegetation to start to make a recovery.

curiosity was piqued, and since then, these crabs have been sharing their life story with us, trusting us as guardians of their future."

Trindade is not only a stronghold for the Johns, but is also the largest nesting ground in Brazil for green turtles. Mouth agape, I watch as, among dozens of crabs, a huge green turtle lumbers across the sand and digs a hole in which to lay its eggs. While the two species tend to keep themselves to themselves for most of the year, their worlds now collide.

Yellow land crabs are predominantly herbivores, but are also opportunistic feeders, preying on carcasses, turtle eggshells and turtle hatchlings. The following morning, the fallout of this behaviour is clear. Many Johns are still loitering among the turtle burrows, the detritus from the previous night's feast scattered across the beach. Most predation on hatchlings occurs at night, when the youngsters are making their way towards the sea.

It's a sad scene, yet a natural one. "When I started working here, I didn't really like the Johns because they ate turtle hatchlings," admits biologist Joice Soares from the Marine Turtle Project, who is also carrying out research. "But everything is in balance here; now they are our fieldwork friends."

AFTER TWO MORE DAYS ON Trindade, my final task is to photograph the crabs at altitude. Many crab species live on beaches, but Johns only come down to the shore to mate and spawn. On Trindade, they are found as high as 600m, including on the slopes of Desired Peak, the island's highest point at 620m. Disappointingly, our planned overnight campout on the mountain is cancelled for logistical and safety reasons, so we plan instead to head for Prince Hill, whose 150m plateau hosts the largest concentration of juveniles, first thing in the morning.

Permission to hike to Prince Hill is granted by the Brazilian Navy at 6am, when it's already first light. Since the crabs are usually back in their burrows by sunrise, and it's a 90-minute walk to the plateau, I know good photos will be almost impossible. I set off regardless, but the sun is soon high in the sky and scorching hot, and only one or two Johns are visible. My optimism starts to fade.

Suddenly, I see a large, brooding cloud making for the island. This is the *pirajá*, a famous rainstorm that refreshes Trindade in a hard-and-fast downpour. Rain is usually a challenge for photographers, but conversely, I know the storm brings one final chance.

All crabs breathe through gills, which require moisture for gas exchange. Terrestrial crabs can use ambient humidity for this process. However, during rain, or when they locate sources of fresh water, they will take advantage of the increased water availability to refresh their gills.

As the *pirajá* approaches and lashes the island, the Johns begin to appear across the landscape, allowing me to capture the photographs I had hoped for. But then the clouds part, the crabs disappear back into their burrows, and it is also my time to leave. The team from São Paulo State University will continue their research in the coming years, uncovering new aspects of the Johns' biology and devising conservation plans. "Protecting the John crabs on Trindade is not just about saving a species," says Marcelo. "It's about learning how to restore and sustain the delicate balance of nature in a rapidly changing world."

Q&A

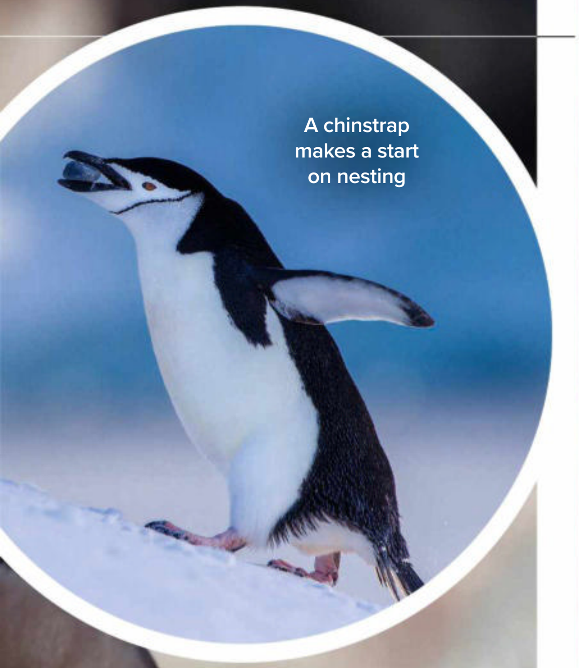
With Stuart Blackman
Email your questions to wildlifemagazine@ourmedia.co.uk

Why do penguins give stones to each other?

There’s not a great choice of nest-building materials in the Antarctic. Pretty much the only things available to gentoo, Adélie and chinstrap penguins are pebbles, which at least serve to raise eggs off the frozen ground.

Pebbles don’t collect themselves and can be hard to find. The males tend to do the bulk of the work and will readily steal from their neighbours to fulfil their parental duties. There are plenty of videos out there of penguins passing the stones from beak to beak to a mate on the nest. This behaviour has inspired the word ‘pebbling’, which has come to describe the swapping of little gifts between human friends or lovers.

If the internet is to be believed, pebbles play another crucial role in gentoo penguin reproduction. The story goes that males try to woo a female by presenting her with a pebble, and she chooses the suitor that brings her the smoothest one. It’s a lovely idea, and easy to imagine that such a ritual might give females clues about a male’s potential as a provider, but any evidence that it’s actually true is hard to come by.


A chinstrap makes a start on nesting

Adélie penguins are named after the wife of the French explorer who discovered them

A buff-tailed bumblebee queen feeds on cherry blossom

How is a queen bee chosen?

People have long peered into beehives and seen a model for human society. There is much to admire – the work ethic, the cooperation, the selflessness. But a hive could equally be seen as a product of a repressive class system, even a tyranny. Because some bees are more equal than others.

By any standard, bees are unusual animals. The vast majority of hive members – female workers – will never produce their own offspring. Instead, they work tirelessly to help another female – the queen – produce hers. The system only works because the queen is usually the workers' mother (or close relative), which means that the workers' genes are still handed down, if via a more circuitous route. Meanwhile, the division of labour between reproductive and physical duties makes the production line more efficient.

> "A queen develops in a spacious brood chamber"

Queens are made, not born. Any fertilised egg has the potential to become either a queen or a worker (males, known as drones, develop from unfertilised eggs). Its destiny is determined by how it is raised. A worker bee is reared in one of the many thousands of identical, hexagonal, wax-walled compartments of the honeycomb. A queen, on the other hand, develops in a spacious brood chamber called a queen cell, which bulges out from the honeycomb.

Developing queens and workers also differ in terms of diet. Immediately after hatching, larvae of both types are fed with royal jelly, a secretion from glands on the heads of adult worker bees. Larvae destined to become workers are given royal jelly for only a couple of days, then are switched to a concoction of pollen and honey called 'bee bread'. Future queens are fed exclusively on royal jelly throughout their development.

Royal jelly contains proteins that are highly influential in the developmental process. They are thought to tweak the 'volume' of certain genes, resulting in anatomical and behavioural differences between queens and workers.

Once they emerge as adults from their cells, most queens will leave their natal hive, with a portion of the workers, to found their own colonies. But if the resident queen is getting old, young ones may stick around and fight amongst themselves – often to the death – for the privilege of replacing her.

Royal jelly itself has come to be seen as an elixir of youth, perhaps because of the relatively long lives of queen bees (up to several years), and it is harvested from queen cells and added to cosmetics and dietary supplements. Its rejuvenating properties are far from proven and it's probably fair to say that the bees make better use of it.

ADELIE PENGUIN: BRENT STEPHENSON/NATUREPL.COM; CHINSTRAP PENGUIN: KLEIN & HUBERT/ NATUREPL.COM; BEE: PHIL SAVOIE/NATUREPL.COM

Crocodilians, such as this American alligator, spend most of their time alone

An alligator's 'winning smile'

How do crocodiles mate?

AS THE OLD JOKE GOES: CAREFULLY! Crocodiles have terrifying predatory instincts and you only have to consider the risks taken by a courting male black widow spider to see how predatory instincts can ruin a beautiful moment.

Crocodiles and their close relatives, the alligators, caimans and gharials (collectively known as crocodilians), are large, lurking, muscular reptiles with sharp teeth, bone-crushing bites and an inclination towards grumpy solitude. Come the breeding season, though, they are more sociable.

Much of crocodilian communication is conducted via sound and they are among the most vocal of all reptiles. They bellow, grunt, growl, hiss and slap the water with heads and tails. American alligators produce an inaudible (to human ears) low-pitched rumble that vibrates the water around them so vigorously that droplets are thrown up into the air. Male gharials have distinctive swellings (called ghara) on the ends of their snouts that amplify the hisses and hornlike sounds issued through their nostrils.

These sounds are broadcast to repel rivals from breeding territories and to attract the attention of mates. Ingenious experiments on Chinese alligators, using helium gas to change the pitch of their vocalisations, have shown that they bellow at a frequency that resonates with their body size. This suggests that the vocalisations provide potential mates and rivals with clues about the size and strength of the bellower.

Females come and go between male territories and a few dominant males get the lion's share of the attention. Crocodilian courtship can be surprisingly tender, involving much touching of snouts, rubbing of necks, blowing of bubbles and resting of heads on each other's backs. In American alligators, courtship is a communal affair, involving large groups of males and females bellowing in chorus. They can be induced to bellow by a low B-flat played on a tuba. In Australia, low-flying helicopters seem to have a similar effect on saltwater crocodiles.

The act of mating itself is fairly straightforward and usually takes place in the water. A female signals she is receptive by assuming a submissive head-up posture and the male mounts her from above, twisting his tail and hind-quarters underneath her so that their genitals are in contact. Like most reptiles, but unlike most amphibians and birds, males are equipped with an erectile penis that delivers sperm close to the site of fertilisation within the female's reproductive tract.

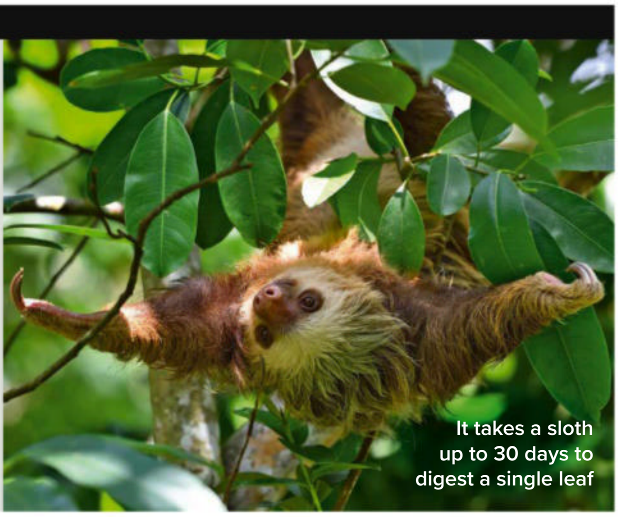
> "Crocodilian courtship can be surprisingly tender"

Intriguingly, some females are able to reproduce without mating at all. In 2018 an 18-year-old female American crocodile in a Costa Rican zoo laid a clutch of 14 eggs, at least seven of which were fertile, despite having been housed separately from other crocodiles for her entire life.

RECORD BREAKER!

What is the slowest land animal?

Many aquatic animals, from bryozoans and corals to sponges and barnacles, spend their whole lives rooted to one spot. They don't need to travel because the currents bring them what they need. On land, animals must actively go and find it – though some are less active than others. Even the fastest snails reach only 0.012kph (or 3.3mm per sec). Among the vertebrates, sloths, which clamber through the trees at an eye-watering 0.24kph, are always going to be hard to lose to. Their gait is designed for efficiency rather than speed, because their leafy diet gives them little energy to play with.


It takes a sloth up to 30 days to digest a single leaf

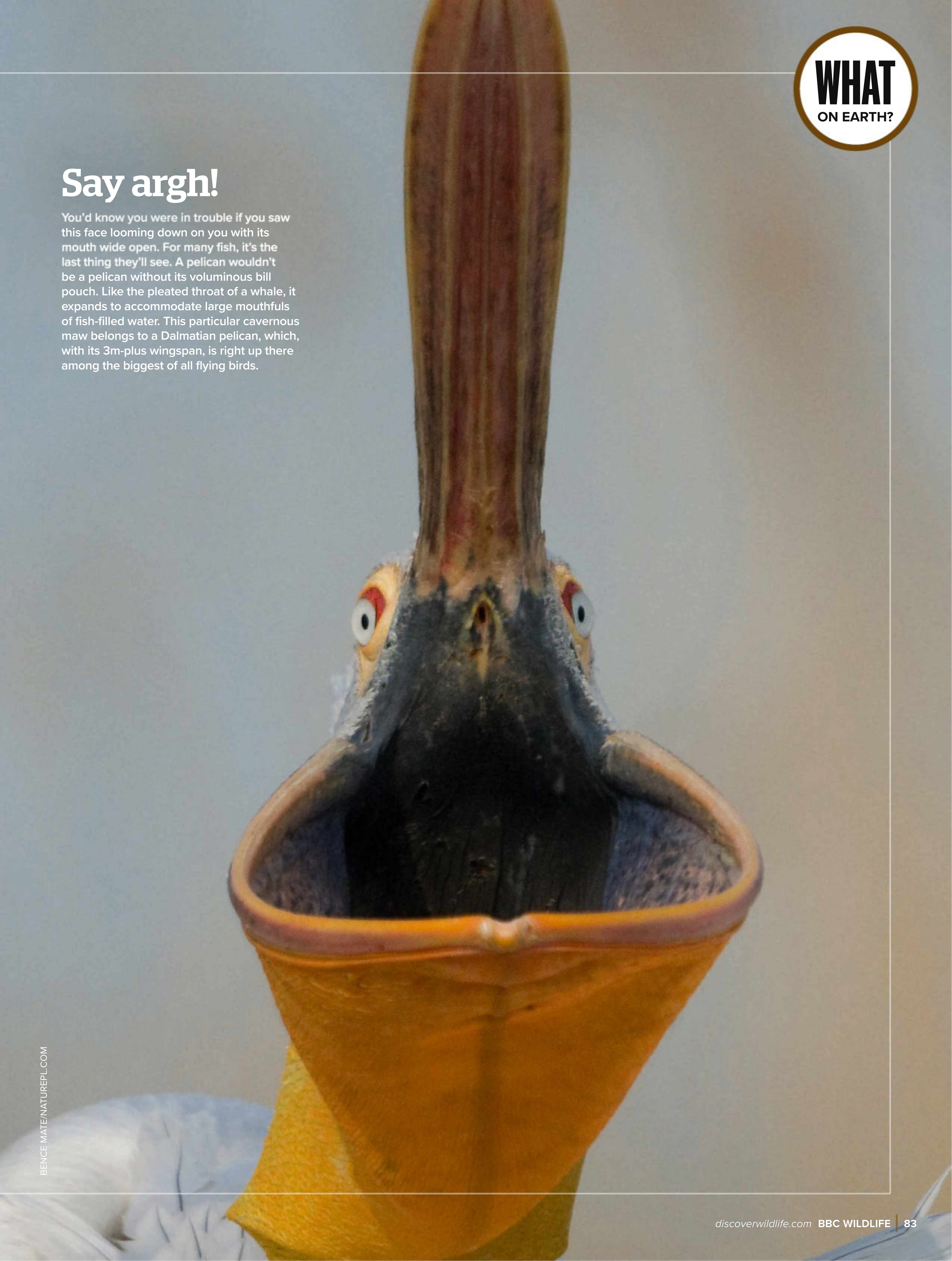
FACT.

Crows might just have an evolutionary edge. Studies have found that corvids can recognise human faces, apparently learning from parents and the flock to identify threatening humans.

SLOTH: GETTY; AMERICAN ALLIGATOR: D WILLIAMS/GETTY; ALLIGATOR TEETH: JOHN DREYER/GETTY

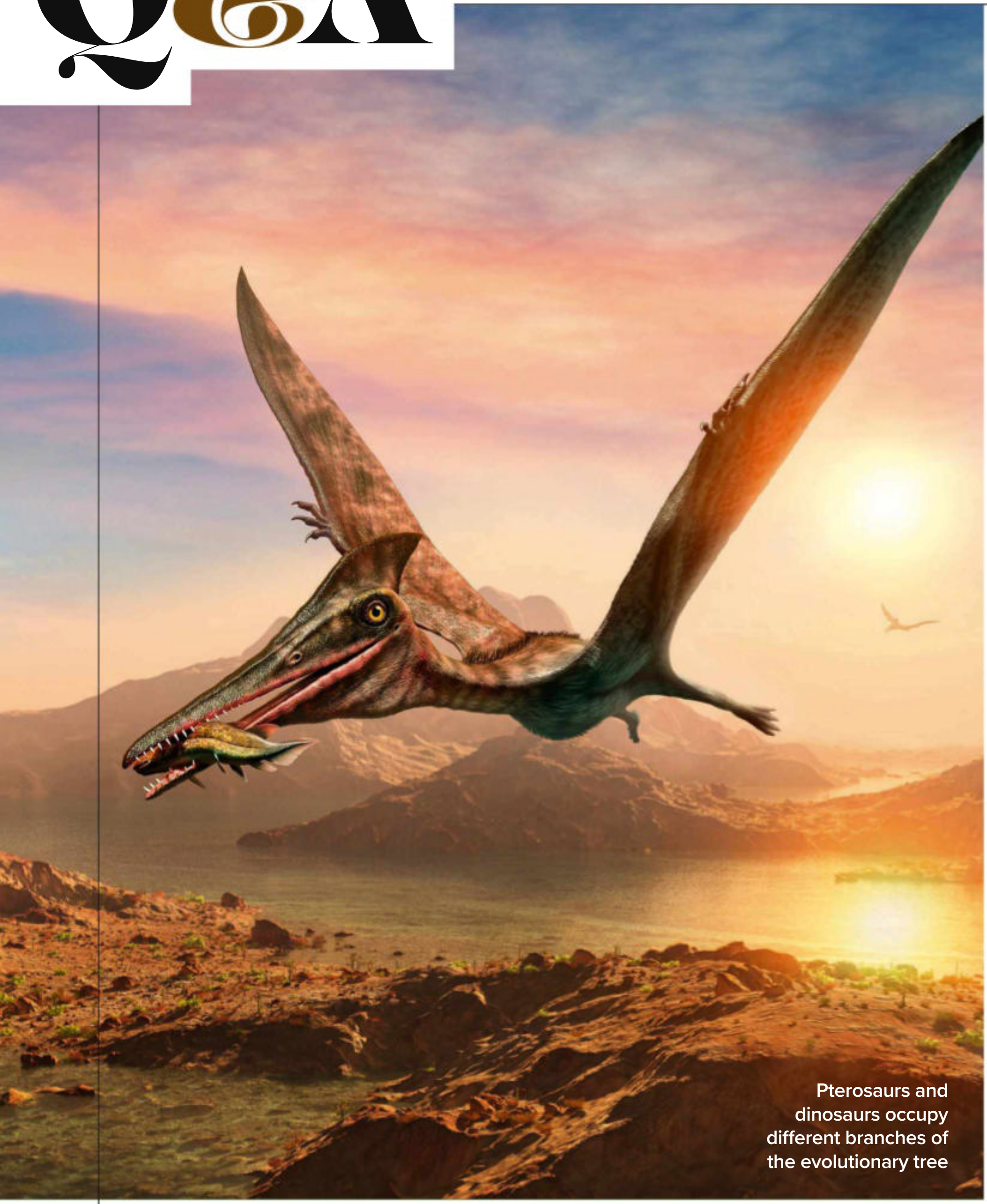
Say argh!

You'd know you were in trouble if you saw this face looming down on you with its mouth wide open. For many fish, it's the last thing they'll see. A pelican wouldn't be a pelican without its voluminous bill pouch. Like the pleated throat of a whale, it expands to accommodate large mouthfuls of fish-filled water. This particular cavernous maw belongs to a Dalmatian pelican, which, with its 3m-plus wingspan, is right up there among the biggest of all flying birds.



BENCE MATE/NATUREPL.COM

Q&A



Pterosaurs and dinosaurs occupy different branches of the evolutionary tree

Why aren't pterosaurs classed as dinosaurs?

THROUGHOUT THE MANY MILLIONS OF years that the likes of *Triceratops*, *T. rex* and *Brontosaurus* dominated the land, pterosaurs ruled the skies. These winged reptiles were the first vertebrates to evolve powered flight and include the biggest flying vertebrates ever to have existed, with wingspans exceeding 10m. Lift was provided not by feathers, but by a membrane of skin stretched between the ankles and elongated fourth fingers.

Pterosaurs are widely referred to as flying dinosaurs. But they aren't dinosaurs for the same reason crocodiles aren't. All three belong to a group called the archosaurs, which split off from other reptilian lineages about 250 million years ago. Dinosaurs, pterosaurs and crocodilians then went their own separate ways not long after that.

Pterosaurs dominated the skies until they were wiped out by the infamous meteor, 66 million years ago. Curiously, the meteor is more commonly credited with finishing off the dinosaurs, but this isn't strictly true. One dinosaur lineage did survive, and it gave rise to modern birds – proper flying dinosaurs.

FAST ANSWERS

A silkworm works on a cocoon

How is silk made?

Silk is a catch-all term for a range of high-strength threads produced by invertebrates to build webs, nests, cocoons and egg-cases. It starts out as a gel-like fluid composed of short protein chains and only solidifies when it is extruded from glands via tiny nozzles. The forces involved in squeezing it out cause the protein chains to interlink, producing gossamer-thin threads. Silkworm caterpillars pupate within a cocoon spun from a single thread hundreds of metres long. Textiles made from it are highly durable and, thanks to the microscopic structure of the fibres, scatter light to produce an attractive shimmering effect.

Has Antarctica ever been ice-free?

Not only has it not always been covered in ice, but Antarctica hasn't always been at the South Pole. Today, the continent is almost entirely buried under 2km of ice that locks up more than half of the world's freshwater, but in times past it has straddled the equator. We have found enough fossils to know that great forests grew there during the Cretaceous period (145-66 million years ago). Until 50 million years ago, Antarctica was still connected to Australia, and until 30 million years ago, to South America. It is thought that marsupials originated in the Americas and then dispersed to Australia via Antarctica.

How fast are bears?

Bears are muscular, stocky and flat-footed, built for strength rather than speed. Nonetheless, you won't outrun one. Reliable numbers are hard to come by, but one well-documented estimate was made in 1930 by a ranger in Yellowstone National Park. He followed four grizzlies in his car, clocking them at an average speed of 48kph. Usain Bolt, the fastest human, reaches only 37.58kph.

Sprinting grizzly

PTEROSAUR: GETTY; SILKWORM: GETTY; GRIZZLY BEAR: PAUL SOUDERS/GETTY

INSTANT EXPERT

Smell: an ancient animal sense

WITH EVOLUTIONARY BIOLOGIST JV CHAMARY

Elephants have an excellent sense of smell

DETECTING CHEMICALS IN THE environment enables an individual to identify molecules secreted by predators or prey, potential poisons and sexual partners. This benefit to survival and reproduction helps explain why smell – olfaction – is probably the oldest sense and evolved 500 million years ago, around the origin of animals.

What's the difference between taste and smell?

The distinction is down to whether a chemical is already dissolved in water or if it is airborne. Your tongue's tastebuds identify five flavours (bitter, salty, sweet, sour and savoury/umami) in liquids, while your nose's sensors can detect numerous odour molecules – odourants – that are airborne before they dissolve in the moist lining of your nasal cavity. But that's for terrestrial species. For aquatic creatures such as fish, all molecules are in water so there's no real distinction between gustation (taste) and olfaction (smell).

How does olfaction work?

The characteristic that we call a 'smell' or scent can be based on either a specific molecule (such as menthol or vanillin) or a combination of multiple odourants. An odour is detected when an odourant binds to its matching olfactory receptor on a sensory neurone (nerve cell). These nerve endings send signals via a neural circuit so only useful information is relayed to the brain. A high concentration of odourants will stimulate plenty of receptors, for example, signalling that an animal should avoid or be attracted to the source (such as a predator or prey).

What happens in invertebrates?

Arthropods use sensory appendages on their heads. Winged insects, such as fruit flies, have thousands of olfactory receptors in their mouthparts and antennae, while decapod crustaceans, such as lobsters, detect odours via short antennules.

Invertebrates and vertebrates use distinct systems but the overall circuitry is similar: numerous sensory neurones lead to a hub (the insect 'mushroom body' or vertebrate 'piriform cortex') that pre-filters signals for the brain. Just as insects have a compound eye for vision whereas vertebrates use a single lens, olfaction has arisen independently in the two groups by convergent evolution.

How do vertebrates smell?

Fish have nostrils leading to olfactory 'rosettes' covered in odour receptors. They must force water toward those rosettes by pumping (using muscles or tiny oar-like cilia) or swimming because odourants travel too slowly via water currents. Amphibians mimic fish and flood their nasal cavity while in water, but on land they act like reptiles, swallowing air to detect odours.

Mammals have a dedicated organ for smell, the nose, which contains scroll-shaped bones called turbinates that direct inhaled air towards millions of receptors on the nasal cavity's surface. Most vertebrates also have an accessory olfactory system with a vomeronasal organ (or Jacobson's organ) to detect chemicals such as pheromones, typically via the mouth – as seen when a snake flicks its tongue in and out.

Which animals have the best sense of smell?

That's usually measured by the number of genes for making olfactory receptors. Fish have about 100 but their genes are diverse so they can sense a wider range of odours. Mammals have more genes, which suggests their smell is more sensitive.

Elephants hold the record with almost 2,000 olfactory genes. Humans have about 400 and dogs 800 genes, but contrary to popular belief, our olfaction isn't so bad: we can detect geosmin, a molecule that gives soil its earthy odour, at a concentration of 5 parts per trillion (equivalent to one drop in four Olympic swimming pools).

And which have the worst?

Possibly toothed whales, such as the bottlenose dolphin, which have only a dozen or so olfactory genes and little neural circuitry for smell. These features were lost after the ancestors of cetaceans (hoofed mammals) evolved from living on land.

Primates like us have poor olfaction compared to other terrestrial mammals in general because we map our vibrant surroundings using colour vision. Smell is useful but, to adapt, it sometimes makes sense to invest in the other senses.

ELEPHANT: STU PORTER/ALAMY; ANTS: ITSIK MAROM/ALAMY

NEXT MONTH

SUPERORGANISMS
All for one, and one for all?

Endurance athletes, wolves can track prey over huge distances

ALL YOU EVER NEEDED TO KNOW ABOUT

Wolves

BY JO PRICE

WOLVES ARE THE LARGEST members of the dog family (Canidae) and can be found in Europe, Asia, North America and Africa. They are highly sociable mammals that typically travel and hunt in packs. These apex predators are a keystone species because they encourage biodiversity and support ecosystems by keeping prey numbers under control. Wolves live in a variety of habitats, including forests, shrublands, wetlands, grasslands, rocky areas and deserts.

What do wolves eat?

These carnivores occur primarily but not exclusively in wilderness and remote areas where there is suitable food. Unsurprisingly, there are usually more wolves where there is more to eat. The wolves' diet mainly consists of large ungulates such as moose, caribou, deer and wild boar, but they are also known to catch smaller mammals. Wolves will also consume livestock, carrion and rubbish.

How do wolves hunt?

Wolves hunt large mammals in packs, outrunning and exhausting their targets: the young, old, injured or sick are often selected. They attack prey by biting the flanks, legs or throat to immobilise it. Higher-ranking members of the pack feed first, followed by the rest. When wolves hunt smaller animals, they tend to hunt alone and rely on stalking and pouncing.

How many species of wolf are there?

Generally, three species of wolf are globally recognised – the grey wolf, red wolf and Ethiopian wolf – and all belong to the *Canis* genus. However, there is debate about the red wolf being a separate species, as some argue it is a subspecies of grey wolf. Before its range was reduced by about one third because of persecution, the grey wolf was the world's most widely distributed mammal (excluding humans). Though the species still faces some threats, it has been assessed as Least Concern. In comparison, the red wolf is Critically Endangered because it was extinct in the wild by 1980 and now only a reintroduced population of about 20 to 30 individuals exists in eastern North Carolina, USA. The Endangered Ethiopian wolf is endemic to the Ethiopian highlands and has a declining population.

How many subspecies of grey wolf are there?

The IUCN lists several subspecies of grey wolf (*Canis lupus*): *C. l. signatus* (Iberia); *C. l. italicus* (Italy, France and Switzerland); *C. l. pallipes* (most of the Asian range from Israel to China); *C. l. arabs* (Arabian Peninsula) and *C. l. chanco* (wolves of the Himalayan range have been proposed as a distinct subspecies). In North America, five subspecies are often recognised: *C. l. arctos* (Arctic wolf), *C. l. lycaon* (Eastern

Wolves are highly social and live in packs

Top: a hungry wolf defends its meal from the attention of others. Above: howling is just one of many wolf vocalisations.

wolf), *C. l. nubilus* (Great Plains wolf), *C. l. occidentalis* (Northern timber wolf) and *C. l. baileyi* (Mexican wolf).

Are there any wild wolves in the UK?

No. Wolves were native to Britain but were hunted to extinction. The last recorded wild wolf in the UK was reportedly killed in Scotland in the late 1600s. There is ongoing debate about reintroducing wolves to certain remote areas of the UK.

What threats do wolves face?

The primary threats to wolves include habitat loss, human-wildlife conflict and illegal hunting. Habitat fragmentation limits their natural range and isolates populations. Human-wildlife conflict particularly occurs where wolves predate livestock. Despite legal protections in many regions, illegal hunting and poaching still threaten wolves. Hybridisation with coyotes (red wolf) and hybridisation with domestic dogs (Ethiopian wolf) are also problematic because they threaten the genetic integrity of the wolf populations.

What is the structure of a wolf pack?

According to the National Park Service, wolves live in a family unit known as a pack, which consists of a mated pair and their offspring, and other non-breeding adults, though variations to this structure do exist. In a pack, the alpha male and female (breeding pair) lead the pack and exhibit their dominance through posturing, scent-marking and food ownership.

How do wolves communicate?

Communication is key to the survival of a wolf pack. Wolves howl for different purposes, including to advertise claim on a territory and to find mates. When a wolf howls, the sound can be heard from 16km away. These canines also yelp, snarl, whimper, whine, growl and bark. Wolves rely on body language and their incredible sense of smell to communicate. They scent-mark to denote territory and presence.

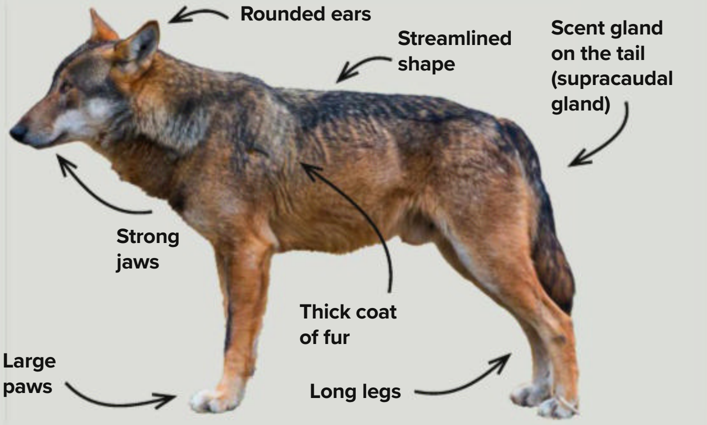
How do wolves reproduce?

At about two to three years, wolves start mating, and a breeding pair will produce a litter of pups every year. Pups are born in spring and reared in a den for the first six weeks, initially relying on their mother's milk. After they are weaned, other members of the pack help raise them by feeding them regurgitated food. Young start travelling with the adults at about seven to eight months old. Typically, they will stay in the natal pack for about two years before joining other packs or starting their own.

A WOLF'S SPECIAL FEATURES:

AT A GLANCE

Family: Canidae
Weight: up to 80kg (*Canis lupus*)
Head to tail length: up to 1.6m
Lifespan: 8 to 13 years in the wild
Speed: up to 64kph over short distances



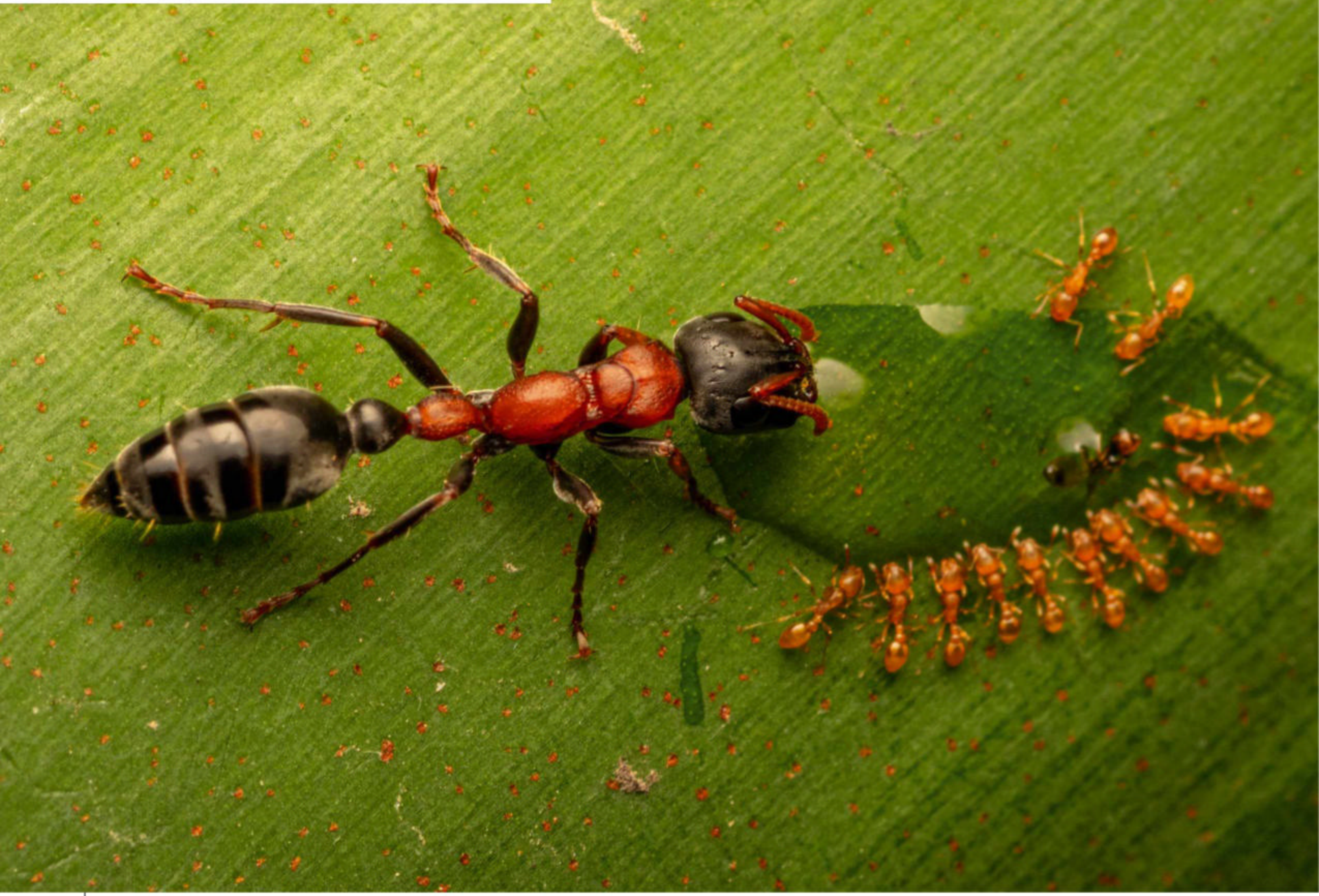
NEXT MONTH

CANE TOADS

Highly toxic amphibians

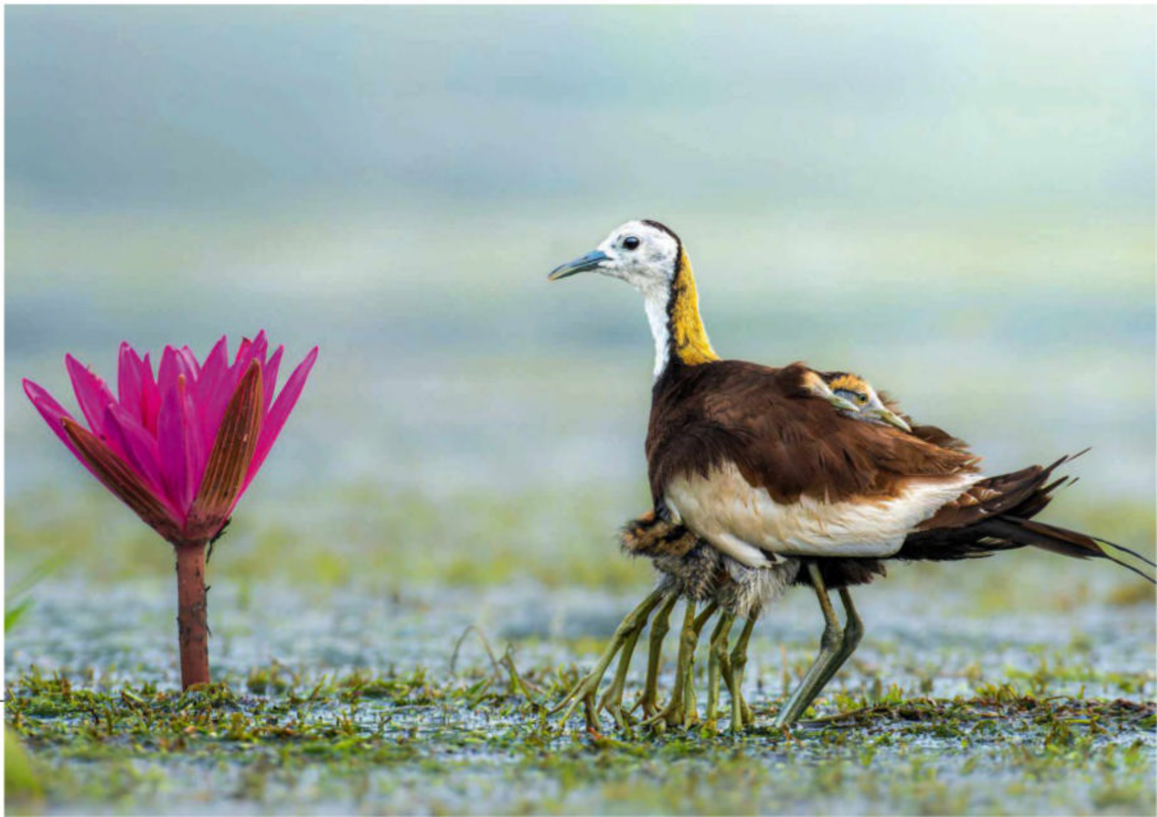
MAIN WOLF: ALAMY; FEEDING WOLF: GERARD LACZ/ALAMY; WOLF PACK: ALAMY; SPECIAL FEATURES C.L. ITALICUS (CAPTIVE): SAVERIO GATTO/ALAMY; HOWLING WOLF: BUITEN-BEELD/ALAMY; CANE TOAD: ALAMY

Photo CLUB



Little and large

Walking in my garden one afternoon, I spotted this large *Tetraponera* ant drinking alongside some smaller ants. Within seconds, the smaller ants became scared of their larger cousin and ran away.
Dipanjan Pal,
Kolkata, India



Hideaway

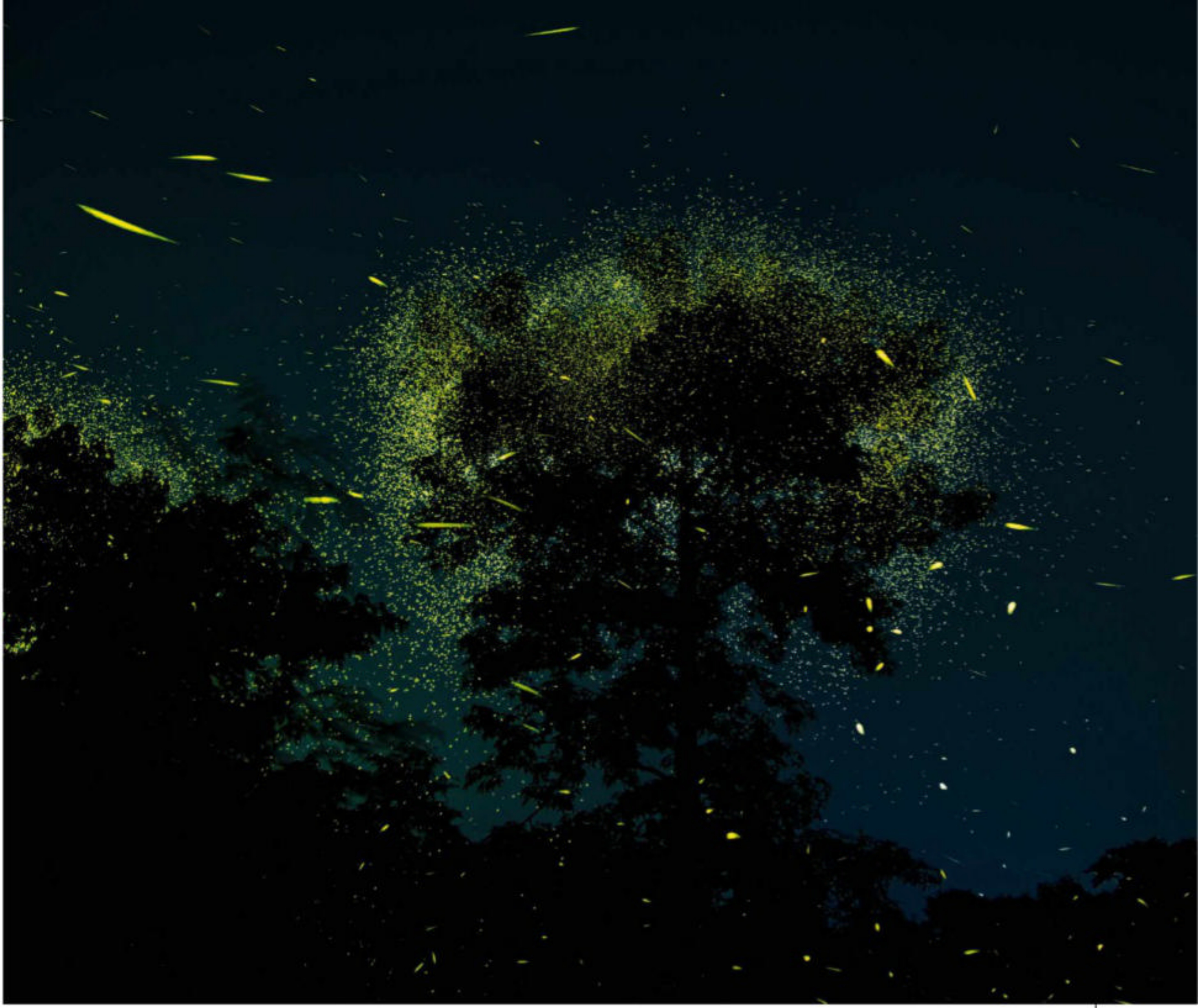
Pheasant-tailed jacana chicks take shelter under the wings of their parent. The legs of the chicks and the two cute heads appearing above make this scene special to me.
Niranjan Karmakar,
Asansol, India

SHARE!

Send your pics to **discoverwildlife.com/submit-your-photos** to see them in print!

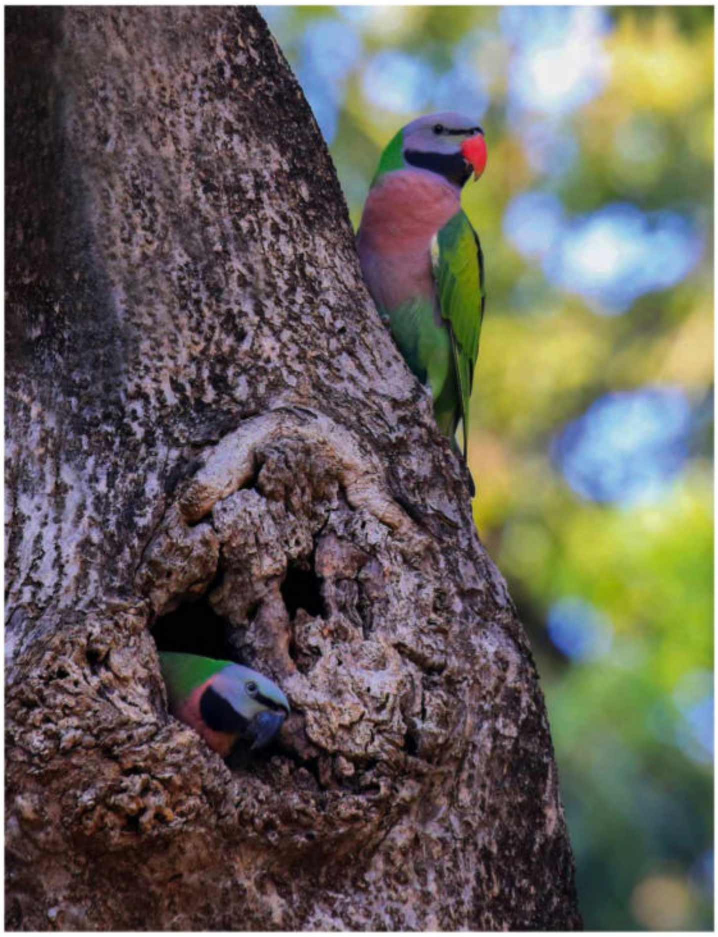
Night glow

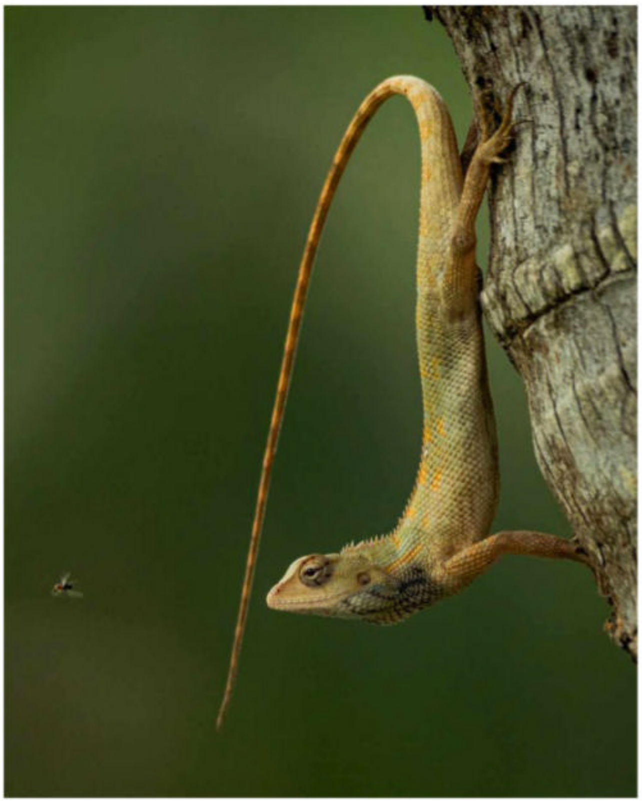
Fireflies are most active during the monsoon season, when you can see a synchronised, rhythmic blinking in the forests.
Pratap Patra, Khargapur, India



Friends in high places

Two red-breasted parakeets observe their surroundings, their keen eyes scanning for signs of food or potential threats.
Dakshesh Ashra, Mumbai, India





On the fly

After repeatedly trying to use its tail to keep a small fly away, this oriental garden lizard eventually made the fly its breakfast.
Dipanjan Pal, Kolkata, India

Renato ready for the cold season in Svalbard

SNAP-CHAT

WITH *BBC WILDLIFE* PICTURE EDITOR TOM GILKS

Renato Granieri talks chimps, penguins and high altitudes

How did your career in wildlife photography start?

After spending 15 years working behind desks for large corporations, I made the decision to quit and start a career in nature photography. I can proudly say that I have been enjoying life as a wildlife photographer since 2014. Photography has given me the opportunity to have a much more dynamic existence, to travel the world and see things differently. I don't see it as a job, rather a thrilling journey.

What is the current focus of your photography work?

I support Tacugama Chimpanzee Sanctuary near Freetown, Sierra Leone, where staff care for orphans whose parents have been killed for bushmeat, and also rehabilitate injured individuals. I have been visiting the sanctuary since 2020, taking photographs and making films that tell the story of these chimps, and that raise awareness of wildlife crime and other environmental issues. It's not always been an easy topic, but it's paramount to preserve the country's wildlife and habitats, and to support local communities.

What have been the toughest conditions you've ever had to cope with?

I am fairly used to challenging environments – I've spent most of my photography career either in the freezing cold, or in hot and steamy environments such as equatorial jungles. Where I do struggle is at high altitudes. I remember once working at an elevation of more than 5,000m in Bolivia, and it was very difficult to breathe, eat and sleep.

A carer at Tacugama

What sort of cold conditions have you experienced?

I usually travel to the Arctic and Antarctica in summer, but I have visited Svalbard in winter a few times. Once, I spent several days at temperatures of -25°C. Luckily I had packed a few extra layers of merino wool…

What's been your most memorable encounter with wildlife?

I've spent a lot of time with chimpanzees, both wild individuals in Uganda and Rwanda, and rescued individuals at Tacugama. Chimpanzees have been listed by the IUCN as Endangered since 1996, due to a number of factors, including poaching and habitat loss, and I want to show them in all their splendour and give them the dignity they deserve. Spending so much time with these primates has had a huge impact on my life. They are our closest relatives, and over time my encounters with them have become increasingly memorable. On one occasion, after spending several days with one particular troupe, a female sat in front of me breastfeeding her infant, suggesting a deep level of trust.

Which other species would you like to photograph one day?

At the very top of my list is a long overdue visit to a colony of emperor penguins. I have seen many penguins across the globe, including in South America, South Africa and New Zealand, but I still haven't managed to see the largest penguin species on Earth.

Which item of kit would you never be without, photographic or otherwise?

Someone once said "the best camera is the one you have with you". For me, vision is more important than physical equipment. When I find myself without a camera in front of something interesting, I instead frame the scene in my mind. Doing this keeps my eyes trained to find new angles and perspectives. It helps me to build an idea, a plan, a vision, which I will then go back and execute.

Any tips for budding photographers?

Put aside the technical knowledge of the camera and its features, and focus more on building your own vision. Be bold and determined to achieve your goals. Get inspired by the work of others by visiting photography exhibitions and events. And take part in photography competitions – they can help you understand where you stand in this exciting form of art.

Born in Sardinia, Renato now lives in London and works as a wildlife photographer and tour leader. See his work at renatogranieri.com.

TACUGAMA CARER: RENATO GRANIERI

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Paul’s no longer walking an uphill battle thanks to TURMERIC+

Walking is one of the most beneficial forms of exercise, and also one of the most underestimated in terms of wellbeing. It’s a great way to reach the recommended level of physical activity needed to stay healthy without the toll to joints, ligaments and muscles.

When taking longer walks however, some of us can find it difficult. Paul Goddard, 66, a Nordic Walking instructor from Saffron Walden in Essex, swears by a product called Turmeric+.

‘I decided to become a Nordic Walking instructor in 2009 and started walking 40 to 50 miles a week. Four years ago it became uncomfortable to walk distances that should have been easy for someone of my age and fitness levels. I felt very apprehensive as walking is not only my passion, but my business.’

Paul continues: ‘I started doing some research. I learned that turmeric could be helpful and bought supplements… and then stumbled upon Turmeric+.’

Curcumin, the active ingredient in turmeric, is difficult for the body to absorb, Some turmeric products offer high levels of curcumin but unless this is easily absorbed by the body, the higher amounts make little difference.

This is what led the scientists at FutureYou Cambridge to create Turmeric+ using the patented ‘Curcuma Phospholipid Complex’ formulation. It’s 30 times more absorbable than standard turmeric and contains vitamin C and D, which contributes to normal collagen formation for the normal function of cartilage and normal muscle function.

‘Soon after taking it I experienced that ‘**light-bulb**’ moment’

‘Soon after taking it I experienced that ‘light-bulb’ moment - I realised my knees felt like they used to. I take Turmeric+ religiously now. I walk around 200 miles a month and even my customers have remarked on my mobility.

‘Walking is great for fitness as well as your mental health. Being able to walk easily has made a huge difference to my life and I feel fitter now than I did twenty years ago.’

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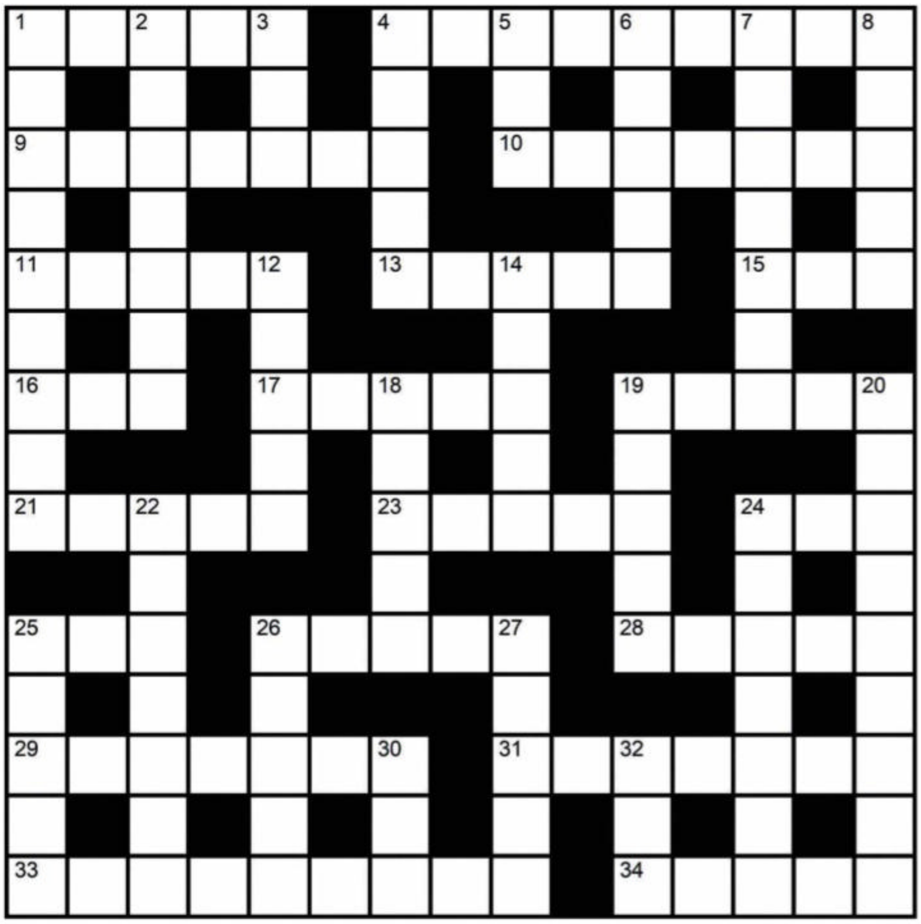
wild PUZZLES

The crossword



ACROSS

1 National park in Canada, home to wolverine, elk and grizzly bear (5)
4 Thick-furred marine mammal (3,6)
9 Predatory sea snails (7)
10 ___ mouse, small farmland rodent (7)
11 Bloodsucking invertebrate (5)
13 Rounded segment of an oak leaf, for example (5)
15 Female swan (3)
16 Tree in the laurel family (3)
17 Songbird of Asia and the Americas, often greenish in colour (5)
19 African bird on the wattle-eye family (5)
21 Large sea duck, sometimes called a cuddy (5)
23 Another name for a snow leopard (5)
24 Large flightless bird (3)
25 Venomous snake (3)
26 Leafy plant also called a plantain lily (5)
28/30 Social insect that builds its nest from mud (5,3)
29 Flatfish that may be Pacific, longfin or speckled (4,3)
31 Iconic flowers of South Africa, also called sugarbushes (7)
33 Tropical plants in the genus *Microgramma* (5,4)
34 ___ wolf, canine of South America (5)

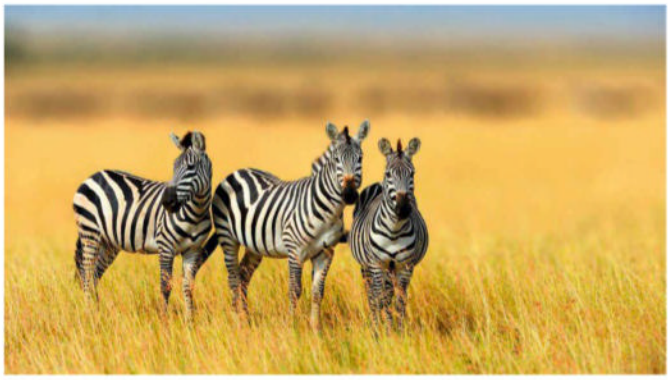
DOWN

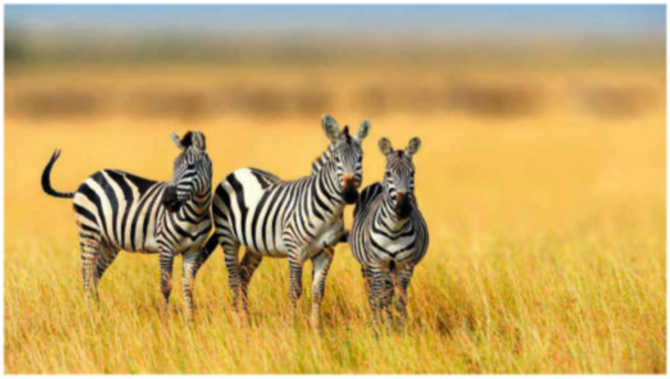
1 Flying insect, usually social – may be buff-tailed (9)
2 Habitat for juvenile animals (7)
3 Vixen or dog (3)
4 Mexican agave, cultivated for fibre (5)
5 Tree species afflicted by *Hymenoscyphus fraxineus* (3)
6 Flowering vetches (5)
7 Circular marking on a moth, butterfly or caterpillar, perhaps (7)
8 ___ bowerbird, glossy blue-black bird of Australia (5)
12 Remain stationary in flight (5)
14 ___ bear, large ursine of Eurasia and North America (5)
18 Underground organs of vascular plants (5)
19 Narrow, deep-bodied fish that may be common or sea (5)
20 ___ monkey, Asian primate (4-5)
22 Water flea (7)
24 ___ bluebird, US songbird (7)
25 Wild equines (5)
26 ___ sparrow, another name for the dunnock (5)
27 Deciduous tree of cool climates (5)
30 See 28 Across
32 Cave-dwelling salamander (3)

December crossword

Across: 1 maples, 5 mahogany, 9 poorwill, 10 cherry, 11 red admiral, 12 tree, 13 noble rot, 16 sakers, 17 calves, 19 cabbages, 21 agar, 22 roadrunner, 25 St John, 26 ophidian, 27 spotless, 28 stylet.
Down: 2 anole, 3 larva, 4 skimmer, 5 mole rat, 6 hackles, 7 great skua, 8 nurse tree, 14 orange-tip, 15 liverwort, 18 strange, 19 chamois, 20 birches, 23 noddy, 24 Edale.

SPOT THE DIFFERENCE





ALAMY

The black stripes on a zebra absorb more heat than the white stripes, and it's thought this helps create air currents that cool the ungulates. Can you spot all five differences between the two images? Turn to page 94 to find the answers.

Your LETTERS

December's cover star: the red panda

We need more control over fireworks to protect wildlife

IT WAS WONDERFUL TO SEE YOUR December issue cover photo of a red panda, yet so sad to read the recent news of the death of a baby red panda at Edinburgh Zoo. With fireworks becoming more prevalent, surely there could be controlled zones or regulations. I wonder if there are studies available, or articles by journalists, looking at the effect that fireworks have on wildlife. They could be used to strengthen the case. I have witnessed some sad reactions to fireworks on trailcams. All animals and animal lovers deserve a voice, but we seem to be unheard.
Kathryn Spedding, Buckinghamshire

Missing cat

Why is *Acinonyx pardinensis*, the compelling giant European cheetah, missing from the Top 10 article on prehistoric cats in the December issue? *A. pardinensis* is currently thought to have occurred in Europe from about 3.5 million years ago to as recently as 0.5 million years ago, with fossil material obtained from sites in France and Germany. Based on morphological evidence, it was far larger than the modern cheetah and I have been privileged to personally sample cranial remains. Additional fossil samples of *A. pardinensis* are also being obtained from other sites for a pioneering study to investigate evolutionary development of cheetah lineage in relation to geography.

By comparison, the status of *Miracinonyx*, the American cheetah, is unclear and contested by some. Hence its inclusion in the article at the expense of the more notable and as yet uncontested giant European cheetah is bewildering. It's surely of real interest to UK and European readers. In short, a serious omission.
Léna Godsall Bottriell, Bedfordshire

WILL NEWTON REPLIES:
There are just so many interesting prehistoric cats! I chose the ones I personally find most interesting and know the most about. The omission of *Acinonyx pardinensis* doesn't make it any less valid than the prehistoric cats that made the list, and if there had been room for more then it might have been considered. As a group, cheetahs are fascinating cats with an interesting evolutionary history – perhaps they warrant an article of their own.

Calendar feedback

What a brilliant calendar this year! Only one furry mammal – the otters. You get extra points for the manta ray on the cover, plus for featuring the silky shark and the seahorse inside, for not having too many birds, and for the inclusion of a reptile: the turtle. The only deficit was the lack of an amphibian but the marine theme this year ruled that out.
Nigel Marshall, via email

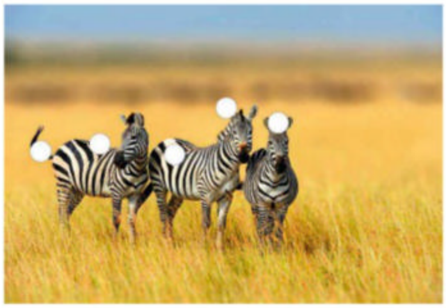
I'd like to express my disappointment with the calendar this year. I always look forward to it and hang each year's edition in my little 'office', and have done so for well over 20 years. This year's is so cold and watery that I've ordered the *Countryfile* calendar instead.

My interest is in land mammals, and there are only sea otters. I also don't want to be cooled down with snowy pictures in winter – that's when I'd welcome sunny pictures to cheer me up. Keep the snowy ones to cool me down in August.
Pam Turner, via email

Bald eagles

I read Daniel Graham's article on discoverwildlife.com on bald eagles dying from lead poisoning in New York State and found it very factual and well written. I live in West Virginia, where bald eagles soar on the thermals (quite the sight) and we have a raptor rescue centre. Lead is the primary cause of death in bald eagles, but all it would take is for hunters to remove the lead bullets from their kill, which is mostly deer. Just one quick action could save America's national symbol.
Sherry Hill, via email

CORRECTIONS
2025 Calendar
The image for the month of December actually shows right whales, not humpback whales, as stated in the caption.



Answers to Spot The Difference on page 93

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BBC wildlife

Macaroni penguins at their breeding site in Hercules Bay, South Georgia

NEXT MONTH

Mission penguin

In 2012, following the death of her husband, photographer Ursula Clare Franklin set herself a challenge: to see and capture all 18 species of penguin in the wild. This quest, which would span several years and take her to some of the most remote corners of Earth, helped Ursula not only to understand these diverse and fascinating birds, but to come to terms with her loss.

ON SALE
6th
FEBRUARY

URSULA CLARE FRANKLIN

Top TEN

Barracuda school

Stonefish

Great white shark

Lionfish are beautiful but venomous

Deadly fish

Be careful if you meet one of these fearsome species underwater

1. Stonefish

Cleverly camouflaged on rock, coral reef or the seabed and capable of staying completely still, stonefish are dangerous because they are practically invisible to the prey they ambush and swallow whole. They're equally deadly to any creature that falls foul of their defensive dorsal spines, which, if the fish is disturbed, stand on end to deliver a powerful venom.

2. Moray eel

These fearsome 3m-long, sea serpent-like predators usually target fish, but have been known to bite divers if they get too close. They have poor eyesight and could mistake a human arm for a tasty meal. Amazingly, they have a second set of jaws that launch into the mouth after the first set has snagged its prey, dragging it into the back of its throat.

3. Pufferfish

Perhaps one of the most famous deadly fish, the pufferfish is a notorious creature that packs a serious neurotoxic punch when consumed. It is considered a delicacy and appears on menus in Japan as 'fugu'. Chefs serving the fish must have a special licence, issued only to those who have been trained to prepare it in such a way that all the toxic parts are meticulously removed.

4. Stingray

These gentle creatures spend their days buried in sand on the seabed or gliding gracefully around the ocean. Yet they have been known to injure people who have accidentally disturbed them, usually by standing on them. The danger comes in the form of venomous barbs along the tail, which the stingray whips when threatened. The stingray's first form of defence, it should be noted, is swimming away.

5. Great white shark

Great whites are awesome super-predators. Attacks on humans are known, yet are very rare. According to the International Shark Attack File, of the confirmed 949 unprovoked attacks by sharks on humans, 351 were by great whites, of which 59 were fatal. Great whites are large in size, measuring up to 6m long and weighing 1,800kg. Their triangular, serrated teeth have evolved for tearing rather than holding their prey. Each row can have up to 300 teeth, constantly replaced throughout an individual's lifetime.

6. Lionfish

Among the softly fluttering fins of a lionfish are more than a dozen spines capable of delivering a dose of venom so powerful that it causes extreme pain and, in rare cases, symptoms that include temporary paralysis, shortness of breath and nausea. Injuries occur when people get too close, whether inadvertently or because they are attempting to capture lionfish for the lucrative aquarium trade.

7. Candiru

This small parasitic fish native to the Amazon basin is widely believed to cause significant damage by entering and swimming up the human urethra. However, reports of this actually happening are anecdotal.

8. Electric eel

Found in South American waters, these eels produce strong electric shocks that can be deadly to humans, especially if swimming, when the shock can cause drowning.

9. Barracuda

Known for their speed and sharp teeth, barracudas can be aggressive and have been known to attack humans, causing severe injuries. It's thought that they mistake humans for fish caught on a spear. Fatalities are rare, though the Florida Museum reports a death off Key West in 1947 that was attributed to a barracuda, and another off the coast of North Carolina in 1957.

10. Piranha

With razor-sharp teeth and the strongest bite force recorded for any fish, the piranha's fearsome reputation is not undeserved. Some species are easily capable of taking a chunk out of a person or snipping off a finger or toe. Most incidents, though, involve just a single bite, and piranhas seem more likely to attack when swimmers disturb their nests on the riverbed. **Debbie Graham**

NEXT MONTH

RAINBOW ANIMALS

From parrots to shrimp

LIONFISH: GEORGETTE DOUWMA/GETTY; BARRACUDA: ALEX SOLICH/GETTY; GREAT WHITE SHARK: REINHARD DIRSCHERL/ALAMY; STONEFISH: CIGDEM UZUN/ALAMY; NEXT MONTH: ALAMY

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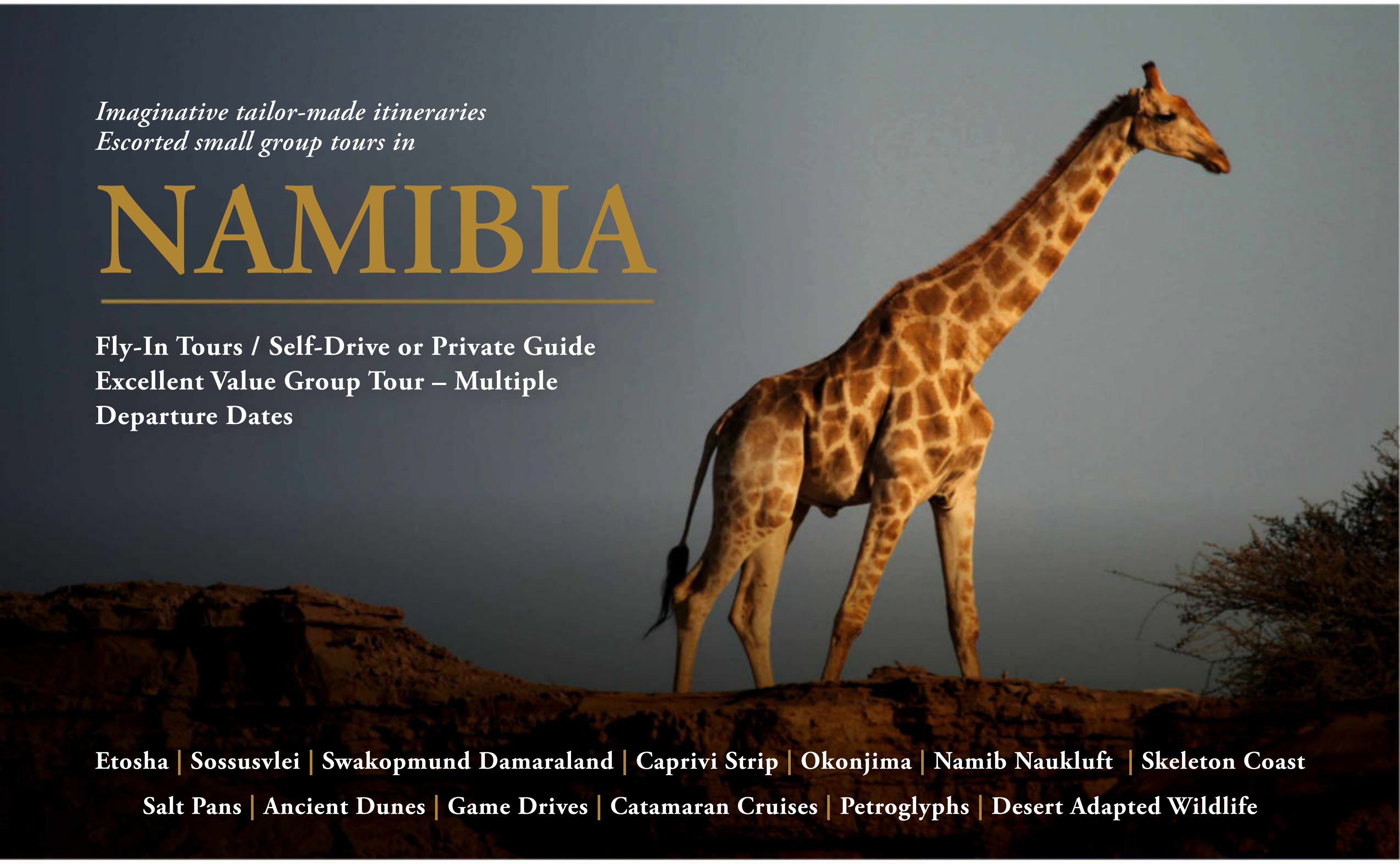

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